

**Draft Economic Analysis of
Critical Habitat Designation for
Seven Pacific Salmon and O. mykiss ESUs**

**U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
501 West Ocean Blvd.
Long Beach, CA 90802-4213**

November 2004

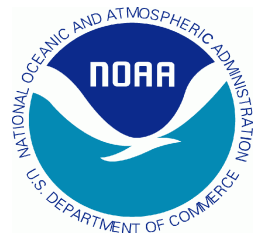


TABLE OF CONTENTS

Executive Summary	ES - 1
ES-1 Introduction	ES - 1
ES-2 Background	ES - 1
ES-3 Framework for the Analysis	ES - 4
ES-4 Economic Impacts of Critical Habitat Designation	ES - 15
 Section 1: Introduction and Background	 1 - 1
1.1 Introduction	1 - 1
1.2 Background	1 - 1
1.3 Pacific Salmon and <u>O. mykiss</u> Biology and Habitat Use	1 - 3
1.4 Overview of Report	1 - 5
 Section 2: Framework for the Economic Analysis	 2 - 1
2.1 Introduction	2 - 1
2.2 General Analytical Framework	2 - 1
2.2.1 Benefit-cost analysis	2 - 1
2.2.2 Cost-effectiveness analysis	2 - 2
2.3 Framework for the 4(b)(2) process	2 - 4
2.4 Framework for analyzing economic impacts of critical habitat designation	2 - 9
2.5 Summary	2 - 14
 Section 3: Baseline Information	 3 - 1
3.1 Introduction	3 - 1
3.2 Geographic Scope of the Critical Habitat Designations	3 - 1
3.3 Economic Baseline	3 - 1
3.4 Statutory and Regulatory Baseline	3 - 6
3.4.1 ESA habitat protections other than Section 7	3 - 6
3.4.2 Other laws and regulations that protect habitat	3 - 8
 Section 4: The Impacts of Section 7 on Habitat-Modifying Activities	 4 - 1
4.1 Introduction	4 - 1
4.2 Consultation History	4 - 1
4.3 Types of Activities	4 - 2
4.3.1 Hydropower dams	4 - 5
4.3.2 Non-hydropower Dams and Other Water Supply Structures	4 - 7
4.3.3 Federal Lands Management and Grazing Permits	4 - 8
4.3.4 Transportation Projects	4 - 9
4.3.5 Utility Line Projects	4 - 9
4.3.6 Instream activities, including dredging	4 - 10
4.3.7 National Pollutant Discharge Elimination System Permitted Activities	4 - 11

4.3.8 Sand and Gravel Mining	4 - 11
4.3.9 Residential and Commercial Development	4 - 12
4.4 The Costs of Section 7 Impacts	4 - 14
4.4.1 Consultation Costs	4 - 15
4.4.2 Per-project Costs and the Occurrence of Impacts	4 - 16
4.4.2.1 Hydropower Projects	4 - 18
4.4.2.2 Non-Hydropower Dams and Water Supply Structures	4 - 21
4.4.2.3 Federal Land Management Activities (excluding grazing)	4 - 22
4.4.2.4 Livestock Grazing on Federal Land	4 - 24
4.4.2.5 Transportation projects	4 - 24
4.4.2.6 Utility Line Projects	4 - 25
4.4.2.7 In-stream activities (excluding dredging)	4 - 26
4.4.2.8 Dredging projects	4 - 27
4.4.2.9 NPDES-permitted Activities	4 - 28
4.4.2.10 Sand and Gravel Mining	4 - 29
4.4.2.11 Residential and Commercial Development	4 - 30
4.5 Summary	4 - 31
Section 5: The Economic Impacts of Critical Habitat Designation	5 - 1
5.1 Introduction	5 - 1
5.2 Aggregating Impacts Up to the Watershed Level	5 - 1
5.3 Differentiating Types of Impacts	5 - 5
5.4 Summary of the Results for 7 Pacific Salmon and <u>O. mykiss</u> ESUs	5 - 7
5.4.1 California Coastal chinook salmon ESU	5 - 9
5.4.1.1 Watershed Characteristics	5 - 9
5.4.1.2 Economic Impacts of Critical Habitat Designation for the Entire ESU ..	5 - 9
5.4.1.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 9
5.4.1.4 Economic Impacts at the Watershed Level	5 - 10
5.4.2 Central Valley spring-run chinook salmon ESU	5 - 11
5.4.2.1 Watershed Characteristics	5 - 11
5.4.2.2 Economic Impacts of Critical Habitat Designation for the Entire ESU ..	5 - 11
5.4.2.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 11
5.4.2.4 Economic Impacts at the Watershed Level	5 - 12
5.4.3 Central California Coast <u>O. mykiss</u> ESU	5 - 13
5.4.3.1 Watershed Characteristics	5 - 13
5.4.3.2 Economic Impacts of Critical Habitat Designation for the Entire ESU ..	5 - 13
5.4.3.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 13
5.4.3.4 Economic Impacts at the Watershed Level	5 - 14
5.4.4 California Central Valley <u>O. mykiss</u>	5 - 15
5.4.4.1 Watershed Characteristics	5 - 15
5.4.4.2 Economic Impacts of Critical Habitat Designation for the Entire ESU ..	5 - 15
5.4.4.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 15
5.4.4.4 Economic Impacts at the Watershed Level	5 - 16

5.4.5 Northern California <u>O. mykiss</u> ESU	5 - 17
5.4.5.1 Watershed Characteristics	5 - 17
5.4.5.2 Economic Impacts of Critical Habitat Designation for the Entire ESU .	5 - 17
5.4.5.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 17
5.4.5.4 Economic Impacts at the Watershed Level	5 - 18
5.4.6 South-Central California <u>O. mykiss</u> ESU	5 - 19
5.4.6.1 Watershed Characteristics	5 - 19
5.4.6.2 Economic Impacts of Critical Habitat Designation for the Entire ESU .	5 - 19
5.4.6.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 19
5.4.6.4 Economic Impacts at the Watershed Level	5 - 20
5.4.7 Southern California <u>O. mykiss</u> ESU	5 - 21
5.4.7.1 Watershed Characteristics	5 - 21
5.4.7.2 Economic Impacts of Critical Habitat Designation for the Entire ESU .	5 - 21
5.4.7.3 Economic Impacts of Individual Activities for the Entire ESU	5 - 21
5.4.7.4 Economic Impacts at the Watershed Level	5 - 22
5.4.8 Aggregate Impacts for all ESUs	5 - 23
5.4.8.1 Watershed Characteristics	5 - 23
5.4.8.2 Economic Impacts of Critical Habitat Designation for All ESUs	5 - 23
5.4.8.3 Economic Impacts of Individual Activities for All ESUs	5 - 23
5.4.8.4 Economic Impacts at the Watershed Level	5 - 24

APPENDICES

<u>Appendix A: List of Watersheds by ESU</u>	A - 1
<u>Appendix B: County Demographics</u>	B - 1
B 1: County and ESU Demographics	B - 1
B 2: County and ESU Income and Employment	B - 5
<u>Appendix C: Watershed Demographics</u>	C - 1
C1: Watershed Demographics (estimated)	C - 1
C 2: Watershed Income and Employment (estimated)	C - 9
<u>Appendix D: Estimating Section 7 Impacts and Costs</u>	D - 1
D 1. Method for estimating annual expected modification costs	D - 1
D 2. Hydropower Dams	D - 4
D 3. Non-hydropower Dams and other Water Supply Activities	D - 17
D 4. Federal Lands Management (including grazing)	D - 24
D 5. Transportation Projects	D - 35
D 6. Utility Line Projects	D - 42
D 7. Instream Activities (including Dredging)	D - 47
D 8. National Pollutant Discharge Elimination System Permitted Facilities	D - 54

D 9.	Sand and Gravel Mining	D - 58
D 10.	Residential and Commercial Development	D - 63
D 11.	Summary	D - 68
<u>Appendix E: Water Supply Impacts Related to Salmon and O. mykiss</u>		E - 1
E 1.	Review of Selected Literature	E - 1
E 2.	Description of Major Water Projects in Critical Habitat Areas	E - 8
<u>Appendix F: Economic Impacts</u>		F - 1
F 1.	Annual Total Impact by Watershed	F - 1
F 2.	Annual Hydropower Dam Impact by Watershed	F - 11
F 3.	Annual Non-hydropower Dam Impact by Watershed	F - 20
F 4.	Annual Federal Lands Management Impact by Watershed	F - 29
F 5.	Annual Grazing Impact by Watershed	F - 37
F 6.	Annual Transportation Project Impact by Watershed	F - 45
F 7.	Annual Utility Project Impact by Watershed	F - 53
F 8.	Annual Instream Activity Impact by Watershed	F - 61
F 9.	Annual Dredging Impact by Watershed	F - 69
F 10.	Annual NPDES-Permitted Activity Impact by Watershed	F - 77
F 11.	Annual Mining Impact by Watershed	F - 85
F 12.	Annual Development Impact by Watershed	F - 93
<u>Appendix G: Energy Effects of Critical Habitat Designation</u>		G - 1
G 1.	Hydropower projects in the Pacific Northwest	G - 1
G 2.	Hydropower dams and critical habitat designation	G - 2
<u>Appendix H: The Impacts of Section 7 Implementation on Pesticide Use</u>		H - 1
H 1.	Estimating the Impacts of Restrictions on Pesticide Use	H - 1
H 2.	Estimated Impacts of Restrictions on Pesticide Use for the Seven California ESUs	H - 3

LIST OF TABLES

Table ES-1:	Number of Watersheds by ESU and State	ES - 7
Table ES-2:	Demographics for Counties and ESUs	ES - 8
Table ES-3:	Income and Employment for Counties and ESUs	ES - 9
Table ES-4:	Major Assumptions and Potential Biases	ES - 13
Table ES-5:	Annual Total Impact of Section 7 Implementation	ES - 16
Table ES-6:	Annual Total Impact by Type of Activity	ES - 18
Table ES-7:	Annual Total Impacts for Individual Watersheds	ES - 21
Table 3-1:	Number of Watersheds by ESU and State	3 - 2
Table 3-2:	Size of Occupied Watersheds by ESU	3 - 3
Table 3-3:	Demographics for Counties and ESUs	3 - 4
Table 3-4:	Income and Employment for Counties and ESUs	3 - 5
Table 4-1:	Federal Agencies involved in 10 or more Pacific salmon and <u>O. mykiss</u> consultations in the SWR	4 - 3
Table 4-2:	Actions involved in Pacific salmon and <u>O. mykiss</u> consultations with greater than five consultations in the SWR	4 - 4
Table 4-3:	Summary of Activity Cost Estimation	4 - 32
Table 5-1:	Industry Groups and Critical Habitat Designation Impacts	5 - 4
Table 5-2:	Activity Types with Local and Non-Local Impact	5 - 6
Table 5-3:	Activity Types and Location	5 - 6
Table D-1:	Estimated Costs of Project Modifications for Hydropower Dams	D - 9
Table D-2:	Economic Impacts Associated with Hydropower Dam Flow Regime Changes	D - 13
Table D-3:	Estimated Annual Expected Costs for Hydropower Dams	D - 15
Table D-4:	Hydropower Dams: Assumptions and Potential Biases	D - 16
Table D-5:	Case Studies of Operational Modification Costs for Nonhydropower Dams	D - 20
Table D-6:	Studies of Water Supply Costs Related to Water Project Operation	D - 22
Table D-7:	Estimated Annual Expected Costs for Non-hydropower Dams	D - 23
Table D-8:	Nonhydropower Dams: Assumptions and Potential Biases	D - 24
Table D-9:	Estimated Costs of Project Modifications for Federal Land Management Activities (excluding Grazing)	D - 28
Table D-10:	Assessment Regions for National Forests and BLM Districts	D - 31
Table D-11:	Estimated Regional Costs for Federal Lands Management Projects	D - 32
Table D-12:	Estimated Annual Expected Costs for Federal Land Management and Grazing	D - 35
Table D-13:	Federal Lands Management: Assumptions and Potential Biases	D - 35
Table D-14:	Typical Project Modifications for Transportation Projects	D - 38
Table D-15:	Estimated Costs of Project Modifications for Transportation Projects	D - 40
Table D-16:	Summary of Transportation Projects Affected by Critical Habitat	D - 41

Table D-17:	Estimated Annual Expected Costs for Transportation Projects	D - 42
Table D-18:	Transportation Projects: Assumptions and Potential Biases	D - 42
Table D-19:	Typical Project Modifications for Utility Line Projects	D - 44
Table D-20:	Estimated Costs of Project Modifications for Utility Line Projects	D - 46
Table D-21:	Estimated Annual Expected Costs for Utility Line Projects	D - 47
Table D-22:	Utility Line Projects: Assumptions and Potential Biases	D - 47
Table D-23:	Typical Project Modifications for Instream Activities (including Dredging)	D - 50
Table D-24:	Estimated Costs of Project Modifications for Instream Activities (including Dredging):	D - 53
Table D-25:	Estimated Annual Expected Costs for Instream Activity Projects	D - 54
Table D-26:	Instream Activities and Dredging: Assumptions and Potential Biases	D - 55
Table D-27:	Estimated Costs of Project Modifications for : NPDES-permitted Facilities	D - 58
Table D-28:	Estimated Annual Expected Costs for NPDES-permitted activities	D - 59
Table D-29:	NPDES-permitted Facilities: Assumptions and Potential Biases	D - 59
Table D-30:	Estimated Annual Expected Costs for Sand and Gravel Mining	D - 63
Table D-31:	Sand and Gravel Mining: Assumptions and Potential Biases	D - 64
Table D-32:	Estimated Costs of Project Modifications for Development Projects	D - 67
Table D-33:	Estimated Annual Expected Costs for Residential & Comm. Development	D - 68
Table D-34:	Development Projects: Assumptions and Potential Biases	D - 69
Table D-35:	Summary of Activity Cost Estimation	D - 70
Table E-1:	Five Management Scenarios	E - 2
Table E-2:	Summary of Effects on Agricultural Production and Value	E - 3
Table E-3:	Summary of Economic Impacts of Agricultural Section Expansion	E - 3
Table E-4:	National Economic Effects on Agriculture (Direct Costs)	E - 5
Table E-5:	Regional Economic Effects on Agriculture	E - 6
Table E-6:	Environmental Water Account Fundings	E - 8
Table H-1:	Derivation of Per Acre California Net Cash Farm Income Estimate per Crop Category	H - 4
Table H-2:	Annual Economic Impacts of Pesticide Restrictions due to Implementation of Buffer Areas	H - 5

LIST OF MAPS

ESU Watersheds and Counties

- Figure 1: 7 Pacific salmon and O. mykiss ESUs in NOAA's Southwest Region
- Figure 2: California Coastal chinook salmon Watersheds
- Figure 3: Central Valley spring-run chinook salmon Watersheds
- Figure 4: Central California Coast O. mykiss Watersheds
- Figure 5: California Central Valley O. mykiss Watersheds
- Figure 6: Northern California O. mykiss Watersheds
- Figure 7: South-Central California O. mykiss Watersheds
- Figure 8: Southern California O. mykiss Watersheds

Economic Impacts of Critical Habitat Designation and Section 7 Implementation

- Figure 9: 7 Pacific salmon and O. mykiss ESUs in NOAA's Southwest Region
- Figure 10: California Coastal chinook salmon Watersheds
- Figure 11: Central Valley spring-run chinook salmon Watersheds
- Figure 12: Central California Coast O. mykiss Watersheds
- Figure 13: California Central Valley O. mykiss Watersheds
- Figure 14: Northern California O. mykiss Watersheds
- Figure 15: South-Central California O. mykiss Watersheds
- Figure 16: Southern California O. mykiss Watersheds

Executive Summary

ES.1 Introduction

The National Marine Fisheries Service (NOAA Fisheries) is proposing to designate critical habitat for five species of Pacific salmon and O. mykiss (*Onchorynchus* spp.) listed under the Endangered Species Act (ESA). The designations will eventually address 20 Evolutionarily Significant Units (ESUs) of these species in the States of Washington, Oregon, Idaho, and California. Section 4(b)(2) of the ESA requires NOAA Fisheries to consider the economic and other impacts of designating a particular area as critical habitat. NOAA Fisheries may exclude an area from critical habitat if it determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless it also determines that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

Because Pacific salmon and *O. mykiss* migrate through a broad range of interconnected habitats, implementation of section 7 of the ESA has potentially large economic and other impacts. This report focuses on the economic costs of critical habitat designation. This focus does not mean that the beneficial and non-economic impacts of critical habitat designation have been overlooked and not incorporated into the designation process. NOAA Fisheries has chosen to express the benefits of designation in terms of the conservation value of designating a particular area as critical habitat. These benefits are gauged with a biological metric and are the subject of a separate report (NMFS 2004a). Other impacts are also covered in separate reports, for example impacts on small businesses.

ES.2 Background

NOAA Fisheries is responsible for determining whether species, subspecies, or distinct population segments of Pacific salmon and O. mykiss (inclusive of anadromous steelhead and some populations of resident rainbow trout) are threatened or endangered, and which areas constitute critical habitat for them under the ESA (16 U.S.C. 1531 et seq). To be considered for ESA listing, a group of organisms must constitute a “species.” Section 3 of ESA defines species as follows: “any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” The agency has determined that a group of Pacific salmon or O. mykiss populations qualifies as a distinct population segment if it is substantially reproductively isolated and represents an important component in the evolutionary legacy of the biological species. A group of populations meeting these criteria is considered an “evolutionarily significant unit” (ESU) (56 FR 58612, November 20, 1991). In its ESA listing of determinations for Pacific salmon and O. mykiss, NOAA Fisheries has treated an ESU as a distinct population segment and to date has identified six species comprised of 52 ESUs in Washington, Oregon, Idaho and California. NOAA Fisheries has determined that resident rainbow trout and anadromous steelhead are part of the same ESU in certain areas (for further discussion see 69 FR 33102; June 14, 2004). In this report, “O. mykiss” ESUs refer to ESUs that include populations of both anadromous steelhead and resident rainbow trout.

Section 4(b)(2) of the ESA requires NOAA Fisheries to designate critical habitat for threatened and endangered species “on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat.” This section grants the Secretary [of Commerce] discretion to exclude any area from critical habitat if he determines “the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat.” The Secretary’s discretion is limited, as he may not exclude areas if it “will result in the extinction of the species.”

The ESA defines critical habitat under section 3(5)(A) as:

- (I) the specific areas within the geographical area occupied by the species, at the time it is listed . . . , on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
- (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.

Once critical habitat is designated, section 7 of the ESA requires Federal agencies to ensure they do not fund, authorize or carry out any actions that will destroy or adversely modify that habitat. This requirement is in addition to the section 7 requirement that Federal agencies ensure their actions do not jeopardize the continued existence of listed species.

On February 16, 2000, NOAA Fisheries published final critical habitat designations for 19 ESUs, thereby completing designations for all 25 ESUs listed at the time (65 FR 7764). The 19 designations included more than one hundred and fifty river subbasins in Washington, Oregon, Idaho, and California. Within each occupied subbasin, NOAA Fisheries designated as critical habitat those lakes and river reaches accessible to listed fish along with the associated riparian zone, except for reaches on Indian land. Areas considered inaccessible included areas above long-standing natural impassable barriers and areas above impassable dams, but not areas above ephemeral barriers such as failed culverts.

In considering the economic impact, NOAA Fisheries determined that the critical habitat designations would impose very little or no additional requirements on Federal agencies beyond those already imposed by the listing of the species themselves. The ESA’s prohibition against adversely modifying critical habitat applies only to Federal agencies, which are also prohibited from jeopardizing the continued existence of listed species. NOAA Fisheries reasoned that since it was designating only occupied habitat, there would be few or no actions that adversely modified critical habitat that also did not jeopardize the continued existence of the species. Therefore, there would be no economic impact as a result of the designations (65 FR 7764, 7765, February 16, 2000).

The National Association of Homebuilders (NAHB) challenged the designations in District Court in Washington, D.C. as having inadequately considered the economic impacts of the critical habitat designations (National Ass’n of Homebuilders v. Evans, 2002 WL 1205743 No. 00-CV-2799

(D.D.C.). NAHB also challenged NOAA Fisheries' designation of Essential Fish Habitat (EFH) (Pacific Coast Salmon Fishery Management Plan, 2000). While the NAHB litigation was pending, the Court of Appeals for the 10th Circuit issued its decision in New Mexico Cattle Growers' Association v. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001) (NMCA). In that case, the Court rejected the FWS approach to economic analysis, which was similar to the approach taken by NOAA Fisheries in the final rule designating critical habitat for 19 ESUs of West Coast salmon and O. mykiss. The Court ruled that "Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes." Subsequent to the 10th Circuit decision, NOAA Fisheries entered into and sought judicial approval of a consent decree resolving the NAHB litigation. That decree provided for the withdrawal of critical habitat designations for the 19 salmon and O. mykiss ESUs and dismissed NAHB's challenge to the EFH designations. The District Court approved the consent decree and vacated the critical habitat designations by Court order on April 30, 2002 (National Ass'n of Homebuilders v. Evans, 2002 WL 1205743 (D.D.C. 2002)).

On September 3, 2003, the Pacific Coast Federation of Fishermen's Associations (PCFFA), Institute for Fisheries Resources, the Center for Biological Diversity, the Oregon Natural Resources Council, the Pacific Rivers Council, and the Environmental Protection Information Center (PCFFA et al., filed a complaint alleging NOAA Fisheries's failure to timely designate critical habitat for the 19 ESUs. NOAA Fisheries filed with the D.C. District Court an agreement resolving that litigation and establishing a schedule for designation of critical habitat.

On July 13, 2004, the D.C. District Court approved a First Amendment to the Consent Decree and Stipulated Order of Dismissal that NOAA Fisheries jointly filed with PCCFA et al. This amendment provides for a revised schedule for the submission of proposed and final rules designating critical habitat for the 20 ESUs to the Federal Register. For those ESUs that are included on the list of threatened and endangered species as of September 30, 2004, and which fall under the responsibility of the Northwest Regional office of NMFS, proposed rules must be submitted to the Federal Register for publication no later than September 30, 2004. For those of the 20 ESUs that are included on the list of threatened and endangered species as of November 30, 2004, and which fall under the responsibility of the Southwest Regional office, proposed rules must be submitted to the Federal Register for publication no later than November 30, 2004. For those of the 20 ESUs addressed in the proposed rules and included on the lists of threatened and endangered species as of June 15, 2005, final rules must be submitted to the Federal Register for publication no later than June 15, 2005. In a separate rulemaking the NMFS Southwest Region intends to address critical habitat for the remaining seven ESUs subject to the amended consent decree.

This proposed rule addresses the following seven ESUs under the jurisdiction of the agency's Southwest Region: (1) California Coastal chinook salmon; (2) Central Valley spring-run chinook salmon; (3) Central California Coast O. mykiss; (4) California Central Valley O. mykiss; (5) Northern California O. mykiss; (6) South-Central California Coast O. mykiss; and (7) Southern California O. mykiss. In separate rulemaking NOAA Fisheries' Northwest Region intends to address critical habitat for the remaining 13 ESUs subject to the PCFFA et al. complaint.

ES.3 Framework for the Analysis

The process of designating critical habitat under the ESA includes analyzing the economic, national security, and other relevant impacts of the designation. The 4(b)(2) exclusion process is conducted for a "particular area," not for critical habitat as a whole. For that reason, the analysis should be conducted at a geographic scale that divides the area under consideration into smaller subareas. The statute does not specify the exact geographic scale of these subareas, nor does it dictate the form of the economic analysis and the nature of the impacts to be included in the analysis.

Economic analyses of regulatory actions commonly use a standard benefit-cost framework. For reasons discussed here and in [4(b)(2) report], NOAA Fisheries has chosen a framework more akin to a cost-effectiveness one. A cost-effectiveness analysis ideally first involves quantifying benefits, for example, percent reduction in extinction risk, percent increase in productivity, or increase in numbers of fish. Given the state of the science, it would be difficult to quantify the benefits of critical habitat designation reliably. It is possible, however, to differentiate among habitat areas based on their relative contribution to conservation. For example, habitat areas can be rated as having a high, medium or low conservation value. Such a rating is based on best professional judgment.

The qualitative ordinal evaluations of conservation value can be combined with estimates of the economic costs of critical habitat designation in a framework that essentially adopts that of cost-effectiveness. Individual habitat areas can then be assessed using both their biological evaluation and economic cost, so that areas with high conservation value and lower economic cost have a higher priority for designation and areas with a low conservation value and higher economic cost have a higher priority for exclusion.

The economic analysis of the costs of critical habitat designation follows the standard approach to regulatory analysis: The regulation under consideration changes the state of the world and any resulting changes in economic activity are then attributed to the regulation. This approach has been called the "baseline approach." It does not assume the world will remain unchanged in the absence of regulation. Instead, it projects a future course of the world as a baseline, one which may involve substantial changes in economic and other conditions. It then projects another course in which the regulation has taken effect. The impacts of the regulation are then analyzed in terms of the differences between the two courses. Changes that would exist in the absence of the regulation are included in the baseline, and so do not add to the regulation's benefits or costs.

Applying this approach to the designation of critical habitat takes the following steps:

1. Identify the baseline of economic activity and the statutes and regulations that constrain that activity in the absence of the critical habitat designation;
2. Identify the types of activities that are likely to be impacted by critical habitat

designation;

3. Estimate the costs of modifications needed to bring the activity into compliance with the ESA's critical habitat provisions;
4. Project over space and time the occurrence of the activities and the likelihood they will in fact need to be modified; and
5. Aggregate the costs up to the watershed level.

In considering the first step of this framework, this analysis notes that the critical habitat areas under consideration for the seven ESUs of Pacific salmon and O. mykiss cover approximately 32 million acres in California. For the purposes of this analysis, each ESU is analyzed separately. This analysis also aggregates many of the results for the seven ESUs considered together. This involves more than just summing the results for each ESU because some watersheds are in more than one ESU. A simple sum would therefore double-count the results from such a watershed.

The 4(b)(2) process is applied not at the level of the designation as a whole, but at the level of a "particular area," which is defined in this analysis as a Hydrologic Sub-Area (HSA), as defined by CalWater, the official California watershed map. A set of nearshore marine areas are also considered and included in the analysis. Figure ES-1 shows the HSA watersheds and nearshore areas for all seven ESUs combined.

Table ES-1 below lists the number of watersheds for each ESU. Tables ES-2 and ES-3 give other baseline information at the ESU level; the report provides this information on a County and individual watershed/nearshore area basis. These tables include all occupied watersheds and nearshore areas considered in the 4(b)(2) process.

**Figure ES-1 Seven Pacific Salmon and *O. mykiss* ESUs
Watersheds In NOAA's Southwest Region**

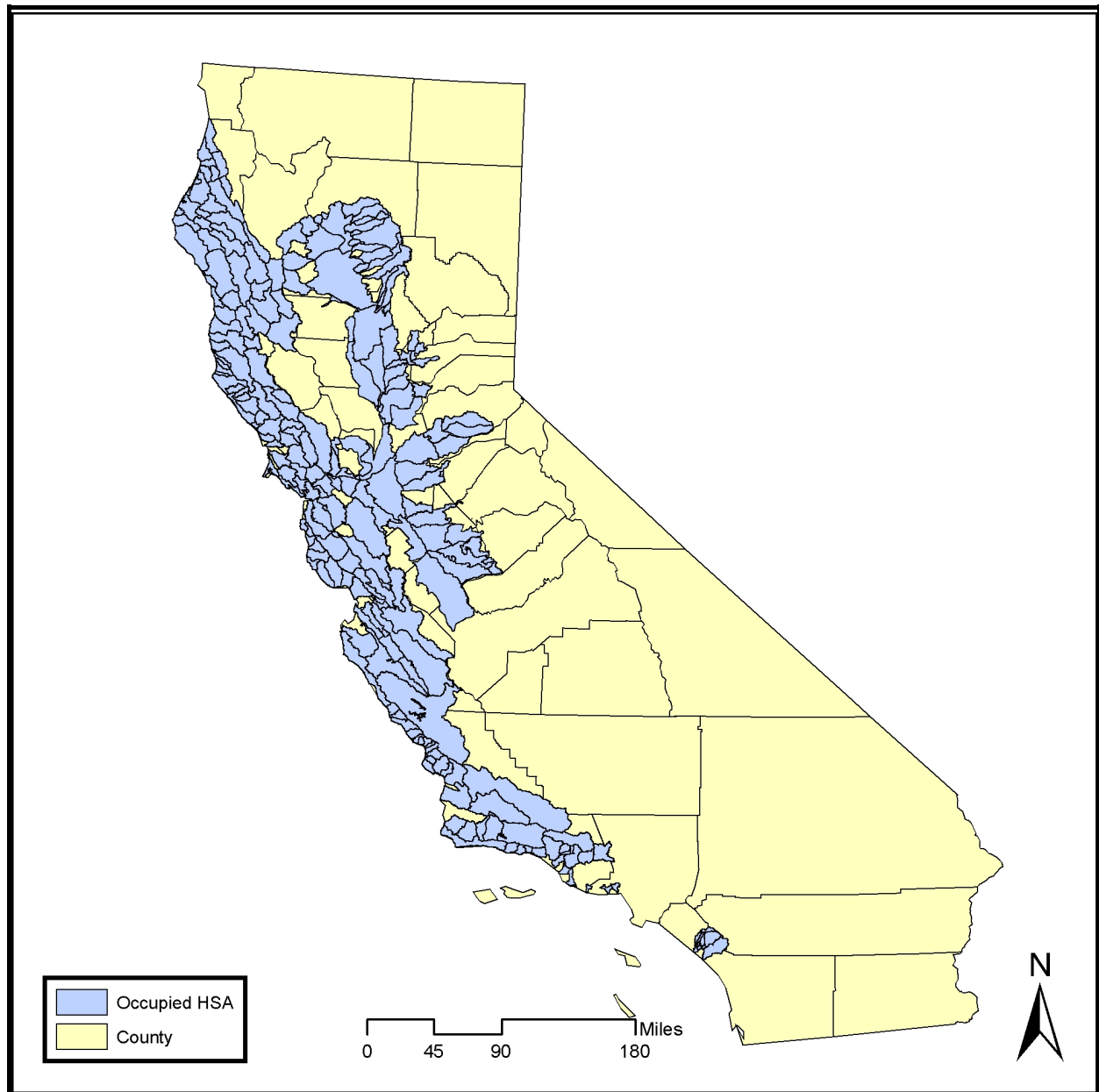


Table ES-1 NUMBER OF OCCUPIED WATERSHEDS BY ESU	
ESU	Watersheds
California Coastal chinook salmon	47
Central Valley spring-run chinook salmon	37
Central California Coast <u>O. mykiss</u>	47
California Central Valley <u>O. mykiss</u>	67
Northern California <u>O. mykiss</u>	52
South-Central California Coast <u>O. mykiss</u>	30
Southern California <u>O. mykiss</u>	37
Notes: The sum of the number of watersheds in each ESU may exceed the actual number of watershed proposed as some watersheds are proposed for designation for more than one ESU.	

Table ES-2
DEMOGRAPHICS FOR COUNTIES AND ESUs

ESU	Population		Area (sq. miles)		Population Density	
	Counties	ESU	Counties	ESU	County	ESU
California Coastal chinook salmon	968,303	428,651	19,461	7,417.00	49.8	57.8
Central Valley spring-run chinook salmon	6,257,268	1,757,987	31,338	7,704	199.7	228.2
Central California Coast <u>O. mykiss</u>	9,418,030	5,741,401	16,278	5,483	578.6	1,047.1
California Central Valley <u>O. mykiss</u>	7,818,201	3,041,659	49,432	13,415	158.2	226.7
Northern California <u>O. mykiss</u>	844,024	169,718	18,673	6,880	45.2	24.7
South-Central California Coast <u>O. mykiss</u>	4,096,822	701,525	19,265	5,892	212.7	119.1
Southern California <u>O. mykiss</u>	18,785,717	784,002	32,514	4,350	577.8	180.2

Table ES-3
INCOME AND EMPLOYMENT FOR COUNTIES AND ESUs

ESU	Personal Income (\$1000)		Total Employment	
	Counties	ESU	Counties	ESU
California Coastal chinook salmon	30,164,000	13,066,000	550,174	248,362
Central Valley spring-run chinook salmon	200,507,000	50,141,000	3,405,202	956,998
Central California Coast <u>O. mykiss</u>	395,433,000	274,221,000	6,048,254	3,909,824
California Central Valley <u>O. mykiss</u>	238,194,000	80,952,000	4,179,904	1,547,107
Northern California <u>O. mykiss</u>	25,462,000	4,048,000	466,207	94,504
South-Central California Coast <u>O. mykiss</u>	153,749,000	23,298,000	2,523,835	406,373
Southern California <u>O. mykiss</u>	571,651,000	26,393,000	10,870,809	478,011

For the second step, the history of NOAA Fisheries consultations for the seven ESUs of Pacific salmon and *O. mykiss* under consideration was examined. The database for these seven ESUs indicates that from 2000 to 2003,¹ the SWR of NOAA Fisheries engaged in over 1,098 consultation and technical assistance efforts, involving roughly 30 different Federal agencies. This consultation history provides a rich source of information on the types of activities that are likely to be affected by critical habitat designation.

From this consultation record, the following set of activity types was developed to be subject to this economic analysis:

- Hydropower dams
- Non-hydropower dams and other water supply structures
- Federal lands management, including grazing (considered separately)
- Transportation projects
- Utility line projects
- Instream activities, including dredging (considered separately)
- EPA NPDES-permitted activities
- Sand & gravel mining
- Residential and commercial development

This set does not cover all possible activities but covers both the majority of consultations and a high proportion of the impacts. There are two important exceptions. In both cases, NOAA Fisheries continues to gather data on these exceptions and will present updated estimates prior to the final draft of the economic analysis.

The first exception is the impact of section 7 implementation on pesticide use. The Environmental Protection Agency (EPA) was recently enjoined from authorizing the application of a set of pesticides within a certain distance from "salmon supporting waters" (Washington Toxics Coalition, et al., v. EPA, C01-0132 (W.D. WA), 22 January 2004). The basis for this injunction was the EPA's failure to consult with NOAA Fisheries concerning possible adverse effects of pesticide application on ESA-protected salmon and *O. mykiss*. The effect of this injunction is to create an additional set of activities to be considered in the analysis, in that the restrictions on pesticide use can be viewed as a habitat-related impact of section 7. Because of the timing of the injunction, however, NOAA Fisheries does not yet have sufficient data to estimate these impacts at the watershed level. Appendix presents preliminary estimates of the impacts at the ESU level, and for the designation of critical habitat for all ESUs as a whole.

The second exception is the impact of changes in the quantity and timing of water flow through dams and other water supply structures, including water withdrawals for irrigation purposes. The necessity, level, and method of flow changes to accommodate the biological needs of Pacific salmon and *O.*

1. Approximately 97 percent of the consultations in the database occurred between 2000-2003. The database is incomplete for earlier years.

mykiss at a particular project are determined on a case by case basis, as is the economic impact associated with any flow change. For example, replacing power generated by peaking projects (i.e., projects that produce hydropower during periods of highest demand) is more expensive than replacing base power production. Until dam operations are reviewed on a case-by-case basis, the type and level of flow changes necessary and feasible for species and habitat protection is speculative, and so the data needed to estimate these impacts are not available. Because of this, the draft report does not include the economic impacts resulting from changes in flow regimes in the cost ranges associated with hydropower and non-hydropower projects.

The following summarizes the cost estimates for each type of activity:

Hydropower Projects

- Projects with installed capacity of less than 5MW: \$2.1 million (\$24,000 to \$4.2 million).
- Projects with installed capacity ranging from 5 to 20 MW: \$5.76 million (\$0 to \$11.5 million).
- Projects with installed capacity of greater than 20 MW that do not have but may require, fish passage facilities: \$73.85 million (\$11.5 million to \$136 million).
- Projects with installed capacity of greater than 20 MW that have, or will not require, fish passage facilities: \$45.23 million (\$11.5 million to \$79.1 million).
- Projects with installed capacities of greater than 20 MW where the status of fish passage is currently unknown: \$56.4 million (\$11.5 million to \$101.3 million).
- Projects with unknown installed capacity: \$7.53 million (\$1.4 million to \$13.6 million).
- Costs of dam removal: \$24 million.
- Dams with known/planned modification costs: various.

Non-Hydropower Dams and Water Supply Structures

- Infrastructure costs: \$2.1 million (\$24 thousand to \$4.2 million).
- Operation of Water Projects (e.g., flow regime, withdrawal constraints): Not quantified.

Federal Land Management Activities (excluding grazing)

- Land management activities (excluding grazing): \$4.91 to \$18.27 per acre per year, depending on region.

Livestock Grazing on Federal Land

- Livestock Grazing: \$29.00 per acre per year (\$11.00 to \$48.00).

Transportation projects

- Bridge and Culvert Projects: \$40,000 to \$103,000 per project (range depends on project mileage).
- Road Projects: \$34,900 - 95,000 per project (range depends on project mileage).

Utility Line Projects

- Outfall Structure and Pipelines: \$101,000 (\$100,000 to \$102,000).

In-stream activities (excluding dredging)

- Boat Dock, Boat Launch, Bank Stabilization: \$54,500 (\$25,000 to \$84,000).

Dredging projects

- Dredging: \$821,000 (\$332,000 to \$1,300,000).
- Dredging of San Francisco Bay: \$651,000 (162,000 to \$1,140,000).

EPA NPDES-permitted Activities

- Temperature Management Plan Compliance activities for Major Projects: \$816,000 (\$582,000 to \$1,110,200).
- Temperature Management Plan Compliance activities for Minor Projects: \$136,000 (\$0 to \$272,000).

Sand and Gravel Mining

- Sand and gravel mining: \$800,000 (\$0 to \$1,600,000).

Residential and Commercial Development

- Residential and Commercial Development: \$235,000 (\$230,000 to \$240,000).

The fourth step used spatial data on the location of projects for each activity type and estimated the annual volume of an activity type in a particular area. Where an activity has different sub-types or scales, a separate volume was estimated for each.

For each type of activity, Appendix D discusses the important assumptions that have the potential to introduce bias to the results, and the likely direction(s) of the bias(es). Table ES-4 below lists some of these assumptions.

Table ES-4 Major Assumptions and Potential Biases	
Assumption	Direction of Potential Bias
For most types of activities, project modifications recommended in biological opinions are included as an impact of section 7 implementation, even if they appear to overlap particular baseline elements, such as fish passage provisions. As a result, the impact of section 7 implementation over and above the baseline elements may be overstated.	+
Costs associated with implementing past consultations are the most reasonable predictor of future costs.	+/-
The historic locations of USACE permits, stormwater permits, and other activities that have a Federal nexus are reasonable predictors of future locations of projects that will be impacted by section 7 implementation.	+/-
Hydropower and non-hydropower projects may be required to provide additional instream flow for salmon and <u>O. mykiss</u> and, as a result, may experience economic impacts to the extent that increased flow results in decreased or redistribution of power generation or other impacts. Specific dam projects that will be required to provide this flow, and how (e.g., spill) the flow augmentation may be achieved, are difficult to predict. The likelihood of a particular project being required to provide flow for salmon and <u>O. mykiss</u> will depend on many factors, including biological significance of the dam project to salmon/ <u>O. mykiss</u> survival and recovery, the seasonality of flow, the economic importance of the dam project, whether there is public concern over the project, and other factors. As a result, costs associated with flow requirements are not included in the cost estimates.	-
For Federal lands management activities, this analysis assumes that each acre of Federal land within critical habitat areas is subject to section 7 implementation. In fact, many projects may not affect salmon and <u>O. mykiss</u> habitat.	+
This analysis assumes that Federal land management agencies carry out land management activities consistently within geographical areas (e.g Cleveland and Sierra National Forests are assumed to conduct the same mix of activities because they fall within the Southern California region). Real variations in geography and management could result in different management activities in each management unit.	+/-

Table ES-4 Major Assumptions and Potential Biases	
Assumption	Direction of Potential Bias
Per-project costs of modifications to specific land management activities are assumed to be uniform across geographic areas.	+/-
The long-term effects of modifying transportation projects in critical habitat areas on regional transportation functions (such as congestion and air pollution) are not included in this analysis. If projects occur that are not included in State transportation plans, this analysis may understate costs.	-
This analysis assumes section 7 implementation will not result in any net reduction in utility transmission capability. The same amount of utility lines will be constructed, although potentially at a higher cost and/or in a different location.	-
This analysis assumes that substitute sites are unavailable to sand and gravel mining companies who are required to reduce mining efforts in salmon and <u>O. mykiss</u> critical habitat areas.	+
- : May result in an underestimate of real costs + : May result in an overestimate of real costs +/- : Has an unknown effect on estimates	

Finally, the fifth step consisted of calculating the economic impact of critical habitat designation for each watershed, using the following formula:

$$\text{Aggregate Annual Impact for Watershed (\$/yr)} = \text{Sum (over all Activity Types)} \left[\text{Activity Type Impact Volume} \times \text{Per-project Cost} \right]$$

These results were used in two ways. First, the 4(b)(2) process used the annual impact for each watershed as a measure of the benefit of excluding that watershed from critical habitat designation. Second, all the watershed-level impacts for each ESU were aggregated to gauge the impacts for the entire extent of the seven critical habitat designations. This latter aggregation is not the same as summing the ESU-level impacts because a watershed can be in more than one ESU, and so a simple summation would double-count such a watershed.

ES.4 Economic Impacts of Critical Habitat Designation

Below, a series of tables is presented that summarizes the results of the analysis for the seven Pacific salmon and O. mykiss ESUs. Table ES-5 gives the annual total impact for each ESU. In this table and in Tables ES-7 and ES-8, the results are presented for six different cases, using three cost estimate levels (Low, Midpoint, High) and two discount rates (7% and 3%). Table ES-6 gives the annual total impact for each type of activity and for each ESU. Tables ES-7 and ES-8 list the average, median, maximum, and minimum annual total impact for the individual watersheds in each ESU.

In assessing the overall cost of the seven critical habitat designations, the figures given below for the individual ESUs cannot be added together to obtain an aggregate annual impact for all ESUs. Some watersheds are included in more than one ESU and so a simple summation would duplicate the impacts for these watersheds. Each table therefore includes the aggregate impacts for all seven ESUs. In all cases, all watersheds considered in the 4(b)(2) process are included, whether or not they are proposed for exclusion.

Lastly, this analysis emphasizes that the impacts listed in these tables and many of the other tables in this report are those that stem from the implementation of section 7 for activities that modify habitat, and are not just the incremental impacts of critical habitat designation alone. As noted above and discussed later in the report, the NMCA decision called for an analysis of "all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes."² The estimates of impacts should then be interpreted as the sum of two types of impacts:

- Co-extensive impacts, or those that are associated with habitat-modifying actions covered by both the jeopardy and adverse modification standards; and
- Incremental impacts, or those that are solely attributable to critical habitat designation and would not occur without the designation.

2. New Mexico Cattle Growers' Association v. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001).

Table ES-5		
Annual Total Impact of Section 7 Implementation		
Discount Rate	Cost Estimate	Annual Total Impact
California Coastal chinook salmon ESU		
7%	High	\$18,015,283
	Midpoint	\$11,651,723
	Low	\$5,286,793
3%	High	\$17,952,763
	Midpoint	\$11,602,446
	Low	\$5,250,824
Central Valley spring-run chinook salmon ESU		
7%	High	\$38,990,850
	Midpoint	\$23,577,391
	Low	\$8,158,872
3%	High	\$34,660,056
	Midpoint	\$21,155,599
	Low	\$7,646,234
Central California Coast <u>O. mykiss</u> ESU		
7%	High	\$16,052,570
	Midpoint	\$9,327,995
	Low	\$2,603,336
3%	High	\$15,902,736
	Midpoint	\$9,178,161
	Low	\$2,453,502
California Central Valley <u>O. mykiss</u> ESU		
7%	High	\$48,152,001
	Midpoint	\$29,187,888
	Low	\$10,215,316
3%	High	\$43,723,423
	Midpoint	\$26,695,165
	Low	\$9,658,746
Northern California <u>O. mykiss</u> ESU		
7%	High	\$16,437,429
	Midpoint	\$10,842,357
	Low	\$5,245,831
3%	High	\$16,383,500
	Midpoint	\$10,801,672
	Low	\$5,218,453
South-Central California Coast <u>O. mykiss</u> ESU		
7%	High	\$16,348,516
	Midpoint	\$10,084,293
	Low	\$3,819,182

Table ES-5		
Annual Total Impact of Section 7 Implementation		
Discount Rate	Cost Estimate	Annual Total Impact
3%	High	\$16,301,760
	Midpoint	\$10,044,341
	Low	\$3,786,076
Southern California O. mykiss ESU		
7%	High	\$32,034,225
	Midpoint	\$21,008,746
	Low	\$9,983,267
3%	High	\$31,999,859
	Midpoint	\$20,974,380
	Low	\$9,948,901
Aggregate Impacts for all ESUs*		
7%	High	\$223,925,100
	Midpoint	\$138,852,170
	Low	\$53,741,978
3%	High	\$217,365,054
	Midpoint	\$135,003,594
	Low	\$52,606,490
* The impact estimate for “all ESUs” includes costs for all the watersheds that were considered for designation and not just the watersheds known to be occupied by one or more of the ESUs		

Table ES-6		
Annual Total Impact by Type of Activity		
Type of Activity	Annual Total Impact	% of total
California Coastal chinook salmon ESU		
Hydropower Dams	\$305,477	2.63%
Non-hydropower Dams	\$1,070,853	9.20%
Federal Lands Management	\$8,926,115	76.71%
Grazing	\$170,220	1.46%
Transportation Projects	\$143,713	1.23%
Utility Line Projects	\$0	0.00%
Instream Activities	\$277,133	2.38%
Dredging	\$116,993	1.01%
EPA NPDES-permitted Activities	\$212,535	1.83%
Sand & Gravel Mining	\$346,667	2.98%
Residential & Commercial Development	\$67,106	0.58%
Central Valley spring-run chinook salmon ESU		
Hydropower Dams	\$9,114,850	38.66%
Non-hydropower Dams	\$1,494,953	6.34%
Federal Lands Management	\$4,782,467	20.28%
Grazing	\$215,192	0.91%
Transportation Projects	\$544,114	2.31%
Utility Line Projects	\$75,750	0.32%
Instream Activities	\$2,438,875	10.34%
Dredging	\$3,623,500	15.37%
EPA NPDES-permitted Activities	\$446,435	1.89%
Sand & Gravel Mining	\$426,667	1.81%
Residential & Commercial Development	\$414,588	1.76%
Central California Coast <u>O. mykiss</u> ESU		
Hydropower Dams	\$10,603	0.11%
Non-hydropower Dams	\$4,855,945	52.06%
Federal Lands Management	\$371,044	3.98%
Grazing	\$17,520	0.19%
Transportation Projects	\$493,644	5.29%
Utility Line Projects	\$0	0.00%
Instream Activities	\$559,443	6.00%
Dredging	\$1,525,845	16.36%
EPA NPDES-permitted Activities	\$857,741	9.20%
Sand & Gravel Mining	\$266,667	2.86%
Residential & Commercial Development	\$369,544	3.96%

Table ES-6		
Annual Total Impact by Type of Activity		
Type of Activity	Annual Total Impact	% of total
California Central Valley O. mykiss ESU		
Hydropower Dams	\$9,830,176	33.68%
Non-hydropower Dams	\$3,042,918	10.43%
Federal Lands Management	\$6,453,845	22.11%
Grazing	\$649,002	2.22%
Transportation Projects	\$937,906	3.21%
Utility Line Projects	\$113,625	0.39%
Instream Activities	\$2,609,188	8.94%
Dredging	\$3,623,500	12.41%
EPA NPDES-permitted Activities	\$675,507	2.31%
Sand & Gravel Mining	\$613,333	2.10%
Residential & Commercial Development	\$638,889	2.19%
Northern California O. mykiss ESU		
Hydropower Dams	\$330,991	3.05%
Non-hydropower Dams	\$233,255	2.15%
Federal Lands Management	\$9,379,479	86.51%
Grazing	\$169,123	1.56%
Transportation Projects	\$24,777	0.23%
Utility Line Projects	\$0	0.00%
Instream Activities	\$246,068	2.27%
Dredging	\$0	0.00%
EPA NPDES-permitted Activities	\$154,301	1.42%
Sand & Gravel Mining	\$293,333	2.71%
Residential & Commercial Development	\$11,031	0.10%
South-Central California Coast O. mykiss ESU		
Hydropower Dams	\$181,565	1.80%
Non-hydropower Dams	\$2,459,780	24.39%
Federal Lands Management	\$4,515,797	44.78%
Grazing	\$1,383,719	13.72%
Transportation Projects	\$160,036	1.59%
Utility Line Projects	\$303,000	3.00%
Instream Activities	\$513,799	5.10%
Dredging	\$162,750	1.61%
EPA NPDES-permitted Activities	\$180,426	1.79%
Sand & Gravel Mining	\$133,333	1.32%
Residential & Commercial Development	\$90,088	0.89%

Table ES-6 Annual Total Impact by Type of Activity		
Type of Activity	Annual Total Impact	% of total
Southern California O. mykiss ESU		
Hydropower Dams	\$0	0.00%
Non-hydropower Dams	\$1,367,723	6.51%
Federal Lands Management	\$14,499,243	69.02%
Grazing	\$99,746	0.47%
Transportation Projects	\$154,074	0.73%
Utility Line Projects	\$707,000	3.37%
Instream Activities	\$490,500	2.33%
Dredging	\$3,284,000	15.63%
EPA NPDES-permitted Activities	\$183,975	0.88%
Sand & Gravel Mining	\$80,000	0.38%
Residential & Commercial Development	\$142,486	0.68%
Aggregate Impacts for all ESUs		
Hydropower Dams	\$31,907,214	22.98%
Non-hydropower Dams	\$18,066,660	13.01%
Federal Lands Management	\$58,052,079	41.81%
Grazing	\$2,431,977	1.75%
Transportation Projects	\$2,688,812	1.94%
Utility Line Projects	\$1,742,250	1.25%
Instream Activities	\$5,871,013	4.23%
Dredging	\$10,571,815	7.61%
EPA NPDES-permitted Activities	\$3,088,065	2.22%
Sand & Gravel Mining	\$1,706,667	1.23%
Residential & Commercial Development	\$2,725,620	1.96%

Table ES-7					
Annual Total Impacts for Individual Watersheds					
Discount Rate	Cost Estimate	Annual Total Impact			
		Average	Median	Maximum	Minimum
California Coastal chinook salmon ESU					
7%	High	\$383,304	\$107,895	\$4,034,048	\$0
	Midpoint	\$247,909	\$67,335	\$2,634,115	\$0
	Low	\$112,485	\$16,711	\$1,233,294	\$0
3%	High	\$381,974	\$107,895	\$4,018,793	\$0
	Midpoint	\$246,861	\$67,335	\$2,625,664	\$0
	Low	\$111,720	\$16,711	\$1,231,690	\$0
Central Valley spring-run chinook salmon ESU					
7%	High	\$1,053,807	\$640,126	\$9,683,126	\$939
	Midpoint	\$637,227	\$422,799	\$5,385,817	\$919
	Low	\$220,510	\$146,148	\$1,146,904	\$900
3%	High	\$936,758	\$636,317	\$6,853,762	\$939
	Midpoint	\$571,773	\$422,799	\$3,818,015	\$919
	Low	\$206,655	\$143,643	\$1,138,313	\$900
Central California Coast <u>O. mykiss</u> ESU					
7%	High	\$341,544	\$205,526	\$1,251,044	\$0
	Midpoint	\$198,468	\$113,479	\$684,401	\$0
	Low	\$55,390	\$36,844	\$224,842	\$0
3%	High	\$338,356	\$205,526	\$1,245,316	\$0
	Midpoint	\$195,280	\$111,345	\$678,674	\$0
	Low	\$52,202	\$36,844	\$221,979	\$0
California Central Valley <u>O. mykiss</u> ESU					
7%	High	\$718,687	\$266,448	\$9,683,126	\$0
	Midpoint	\$435,640	\$161,492	\$5,385,817	\$0
	Low	\$152,467	\$62,157	\$1,146,904	\$0
3%	High	\$652,588	\$266,448	\$6,853,762	\$0
	Midpoint	\$398,435	\$161,492	\$3,818,015	\$0
	Low	\$144,160	\$59,293	\$1,138,313	\$0
Northern California <u>O. mykiss</u> ESU					
7%	High	\$316,104	\$35,618	\$4,034,048	\$0
	Midpoint	\$208,507	\$20,617	\$2,634,115	\$0
	Low	\$100,881	\$3,513	\$1,233,294	\$0
3%	High	\$315,067	\$35,618	\$4,018,793	\$0
	Midpoint	\$207,724	\$20,617	\$2,625,664	\$0
	Low	\$100,355	\$3,513	\$1,231,690	\$0

Table ES-7					
Annual Total Impacts for Individual Watersheds					
Discount Rate	Cost Estimate	Annual Total Impact			
		Average	Median	Maximum	Minimum
South-Central California Coast <u>O. mykiss</u> ESU					
7%	High	\$544,951	\$195,577	\$4,233,149	\$0
	Midpoint	\$336,143	\$119,392	\$2,331,971	\$0
	Low	\$127,306	\$31,961	\$692,428	\$0
3%	High	\$543,392	\$192,714	\$4,230,285	\$0
	Midpoint	\$334,811	\$116,876	\$2,329,107	\$0
	Low	\$126,203	\$30,529	\$692,428	\$0
Southern California <u>O. mykiss</u> ESU					
7%	High	\$865,790	\$264,183	\$7,107,883	\$0
	Midpoint	\$567,804	\$151,743	\$4,684,515	\$0
	Low	\$269,818	\$55,847	\$2,261,148	\$0
3%	High	\$864,861	\$264,183	\$7,107,883	\$0
	Midpoint	\$566,875	\$151,743	\$4,684,515	\$0
	Low	\$268,889	\$55,847	\$2,261,148	\$0
All 7 Pacific salmon and <u>O. mykiss</u> ESUs					
7%	High	\$462,655	\$84,886	\$9,683,126	\$0
	Midpoint	\$286,885	\$56,214	\$5,385,817	\$0
	Low	\$111,037	\$22,763	\$2,261,148	\$0
3%	High	\$449,101	\$84,367	\$8,711,436	\$0
	Midpoint	\$278,933	\$56,214	\$4,995,225	\$0
	Low	\$108,691	\$21,978	\$2,261,148	\$0

Section 1

Introduction and Background

1.1 Introduction

The National Marine Fisheries Service (NOAA Fisheries) is proposing to designate critical habitat for five species of Pacific salmon and steelhead (*Onchorynchus* spp.) listed under the Endangered Species Act (ESA). The designations will address 20 Evolutionarily Significant Units (ESUs) of these species in the States of Washington, Oregon, Idaho, and California. Section 4(b)(2) of the ESA requires NOAA Fisheries to consider the economic and other impacts of designating a particular area as critical habitat. NOAA Fisheries may exclude an area from critical habitat if it determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless it also determines that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

This report analyzes the economic impacts of designating a particular area as critical habitat, based on the best scientific data available.¹ The report covers; seven ESUs in California; 13 ESUs in Washington, Oregon, and Idaho are covered in a separate report. This section provides background information on the proposed designations and discusses the biology and habitat use of Pacific salmon and steelhead. The section finishes with an overview of the rest of the report.

1.2 Background

NOAA Fisheries is responsible for determining whether species, subspecies, or distinct population segments of Pacific salmon and *O. mykiss* (inclusive of anadromous steelhead and some populations of resident rainbow trout) are threatened or endangered, and which areas constitute critical habitat for them under the ESA (16 U.S.C. 1531 et seq). To be considered for ESA listing, a group of organisms must constitute a “species.” Section 3 of ESA defines species as follows: “any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” The agency has determined that a group of Pacific salmon or *O. mykiss* populations qualifies as a distinct population segment if it is substantially reproductively isolated and represents an important component in the evolutionary legacy of the biological species. A group of populations meeting these criteria is considered an “evolutionarily significant unit” (ESU) (56 FR 58612, November 20, 1991). In its ESA listing of determinations for Pacific salmon and *O. mykiss*, NOAA Fisheries has treated an ESU as a distinct population segment and to date has identified six species comprised of 52 ESUs in Washington, Oregon, Idaho and California. NOAA Fisheries has determined that resident rainbow trout and anadromous steelhead are part of the same ESU in certain areas (for further discussion see 69 FR 33102; June 14, 2004). The U.S. Fish and Wildlife Service (FWS) maintains jurisdiction over the rainbow trout components of these *O. mykiss* ESUs. In this report, “*O. mykiss*” ESUs refer to ESUs including

¹ This structure of this report is based on the economic analysis of the proposed designation of the 13 ESUs in the Northwest Region. Primary data for this report were gathered by Industrial Economics, Inc., which also prepared supplementary material for Sections 3, 4, 5 and Appendices D and E of this report.

populations of both anadromous steelhead and resident rainbow trout.

Section 4(b)(2) of the ESA requires NOAA Fisheries to designate critical habitat for threatened and endangered species “on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat.” This section grants the Secretary [of Commerce] discretion to exclude any area from critical habitat if he determines “the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat.” The Secretary’s discretion is limited, as he may not exclude areas if it “will result in the extinction of the species.”

The ESA defines critical habitat under section 3(5)(A) as:

- (I) the specific areas within the geographical area occupied by the species, at the time it is listed . . . , on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
- (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.

Once critical habitat is designated, section 7 of the ESA requires Federal agencies to ensure they do not fund, authorize or carry out any actions that will destroy or adversely modify that habitat. This requirement is in addition to the section 7 requirement that Federal agencies ensure their actions do not jeopardize the continued existence of listed species.

On February 16, 2000, NOAA Fisheries published final critical habitat designations for 19 ESUs, thereby completing designations for all 25 ESUs listed at the time (65 FR 7764). The 19 designations included more than one hundred and fifty river subbasins in Washington, Oregon, Idaho, and California. Within each occupied subbasin, NOAA Fisheries designated as critical habitat those lakes and river reaches accessible to listed fish along with the associated riparian zone, except for reaches on Indian land. Areas considered inaccessible included areas above long-standing natural impassable barriers and areas above impassable dams, but not areas above ephemeral barriers such as failed culverts.

In considering the economic impact, NOAA Fisheries determined that the critical habitat designations would impose very little or no additional requirements on Federal agencies beyond those already imposed by the listing of the species themselves. The ESA’s prohibition against adversely modifying critical habitat applies only to Federal agencies, which are also prohibited from jeopardizing the continued existence of listed species. NOAA Fisheries reasoned that since it was designating only occupied habitat, there would be few or no actions that adversely modified critical habitat that also did not jeopardize the continued existence of the species. Therefore, there would be no economic impact as a result of the designations (65 FR 7764, 7765, February 16, 2000).

The National Association of Homebuilders (NAHB) challenged the designations in District Court in Washington, D.C. as having inadequately considered the economic impacts of the critical habitat

designations (National Ass'n of Homebuilders v. Evans, 2002 WL 1205743 No. 00-CV-2799 (D.D.C.). NAHB also challenged NOAA Fisheries' designation of Essential Fish Habitat (EFH) (Pacific Coast Salmon Fishery Management Plan, 2000). While the NAHB litigation was pending, the Court of Appeals for the 10th Circuit issued its decision in New Mexico Cattle Growers' Association v. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001) (NMCA). In that case, the Court rejected the FWS approach to economic analysis, which was similar to the approach taken by NOAA Fisheries in the final rule designating critical habitat for 19 ESUs of West Coast salmon and O. mykiss. The Court ruled that "Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes." Subsequent to the 10th Circuit decision, NOAA Fisheries entered into and sought judicial approval of a consent decree resolving the NAHB litigation. That decree provided for the withdrawal of critical habitat designations for the 19 salmon and O. mykiss ESUs and dismissed NAHB's challenge to the EFH designations. The District Court approved the consent decree and vacated the critical habitat designations by Court order on April 30, 2002 (National Ass'n of Homebuilders v. Evans, 2002 WL 1205743 (D.D.C. 2002)).

On September 3, 2003, the Pacific Coast Federation of Fishermen's Associations (PCFFA), Institute for Fisheries Resources, the Center for Biological Diversity, the Oregon Natural Resources Council, the Pacific Rivers Council, and the Environmental Protection Information Center (PCFFA et al., filed a complaint alleging NOAA Fisheries's failure to timely designate critical habitat for the 19 ESUs. NOAA Fisheries filed with the D.C. District Court an agreement resolving that litigation and establishing a schedule for designation of critical habitat. The schedule provided for submission by June 30, 2004 to the Federal Register for publication the proposed rule(s) designating critical habitat for those of the 20 ESUs that are included on the list of threatened and endangered species as of June 30, 2004. The District Court approved the agreement on September 12, 2003.

This proposed rule addresses the following seven ESUs under the jurisdiction of the agency's Southwest Region: (1) California Coastal chinook salmon; (2) Central Valley spring-run chinook salmon; (3) Central California Coast O. mykiss; (4) California Central Valley O. mykiss; (5) Northern California O. mykiss; (6) South-Central California Coast O. mykiss; and (7) Southern California O. mykiss. In separate rulemaking NOAA Fisheries' Northwest Region addresses critical habitat for the remaining 13 ESUs subject to the PCFFA et al. complaint.

1.3 Pacific Salmon and O. mykiss Biology and Habitat Use

Pacific salmon and O. mykiss are anadromous fish, meaning adults migrate from the ocean to spawn in freshwater lakes and streams where their offspring hatch and rear prior to migrating back to the ocean to forage until maturity. The migration and spawning times vary considerably between and within species and populations.² At spawning, adults pair to lay and fertilize thousands of eggs in freshwater gravel nests or "redds" excavated by females. Depending on lake/stream temperatures, eggs incubate for several weeks to months before hatching as "alevins" (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles called "fry" and begin actively feeding. Depending on the species and location,

² Groot, C. and L. Margolis, Pacific Salmon Life Histories, Univ. B.C. Press, Vancouver, B.C., 1991, p. 564.

juveniles may spend from a few hours to several years in freshwater areas before migrating to the ocean. The physiological and behavioral changes required for the transition to salt water result in a distinct “smolt” stage in most species. On their journey juveniles must migrate downstream through every riverine and estuarine corridor between their natal lake or stream and the ocean. For example, smolts from Idaho will travel as far as 900 miles from their inland spawning grounds. En route to the ocean the juveniles may spend from a few days to several weeks in the estuary, depending on the species. The highly productive estuarine environment is an important feeding and acclimation area for juveniles preparing to enter marine waters.

Juveniles and subadults typically spend from one to five years foraging over thousands of miles in the North Pacific Ocean before returning to spawn. Some species, such as coho and chinook salmon, have precocious life history types (primarily male fish) that mature and spawn after only several months in the ocean. Spawning migrations known as “runs” occur throughout the year, varying by species and location. Most adult fish return or “home” with great fidelity to spawn in their natal stream, although some do stray to non-natal streams. Salmon species die after spawning, while O. mykiss may return to the ocean and make repeat spawning migrations. This complex life cycle gives rise to complex habitat needs, particularly during the freshwater phase.³ Spawning gravels must be of a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads and boulders in the stream, and beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off channel areas) and from warm summer water temperatures (coldwater springs and deep pools). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. During all life stages salmon and O. mykiss require cool water that is free of contaminants. They also require rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

The homing fidelity of salmon and O. mykiss has created a meta-population structure with distinct populations distributed among watersheds.⁴ Low levels of straying result in regular genetic exchange among populations, creating genetic similarities among populations in adjacent watersheds. Maintenance of the meta-population structure requires a distribution of populations among watersheds where environmental risks (e.g., from landslides or floods) are likely to vary. It also requires migratory connections among the watersheds to allow for periodic genetic exchange and alternate spawning sites in the case that natal streams are inaccessible due to natural events such as a drought or landslide. More detailed information describing habitat and life history characteristics of the ESUs addressed in this rulemaking is described later in this report.

³ Spence, B.C. et al., An Ecosystem Approach to Salmonid Conservation, TR-4501-96-6057, ManTech Environmental Research Services Corp., Corvallis, Oregon, 1996.

⁴ McElhany, P., et al., Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units, U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-42, 2000, p. 156.

1.4 Overview of Report

Because Pacific salmon and O. mykiss migrate through a broad range of interconnected habitats, implementation of section 7 of the ESA has potentially large economic and other impacts. This report covers some of these impacts, focusing on the economic costs of critical habitat designation. This focus does not mean that the beneficial and non-economic impacts of critical habitat designation have been overlooked and not incorporated into the designation process. As explained in Section 2 below, NOAA Fisheries has chosen to express the benefits of designation in terms of the conservation value of designating a particular area as critical habitat. These benefits are gauged with a biological metric and are the subject of a separate report. Other impacts are also covered in the separate report, including the treatment of Department of Defense (DOD) and tribal lands (SWR 4(b)(2) report).

Section 2 of this report outlines the framework for the economic analysis and explains the process NOAA Fisheries is using to consider particular areas for exclusion. That section explains how economic analysis fits into that process and outlines the methods used to gauge the economic impacts. Section 3 describes the economic and legal conditions that account for the baseline of the analysis. This section includes socioeconomic descriptions of the areas covered by the proposed designations, as well as information on other laws and regulations that afford Pacific salmon and O. mykiss some level of habitat protection. Section 4 describes the types of activities affected by critical habitat designation and the costs of modifications needed to comply with section 7. That section of the report also describes the methods used to project the occurrence of these activities over space and time. Finally, Section 5 presents a summary of the results of the analysis for each ESU. The report also contains a series of appendices that give the full set of results and greater details on other issues.

In most cases, we present the result of the analysis in two ways. First, the 4(b)(2) process is conducted at the level of a “particular area,” which we have defined as a Hydrologic Sub-Area (HSA), as defined by CalWater, the official California watershed map. The 4(b)(2) process therefore uses the annual impact of section 7 implementation for each watershed as a measure of the benefit of excluding that watershed from critical habitat designation. Second, we present aggregated results at the ESU-level and for all ESUs combined. Regulatory determinations such as those imposed by the Regulatory Flexibility Act, E.O. 12866, and E.O. 13211 are conducted at the level of the regulation as a whole. The analysis supports these determinations by aggregating all the watershed-level impacts for each ESU to gauge the impacts at the ESU level. Similarly, we aggregated all watersheds regardless of the ESUs to gauge the impacts for the entire extent of the seven critical habitat designations. This latter aggregation is not the same as summing the ESU-level impacts because a watershed may be in more than one ESU, and so a simple summation would double-count such a watershed.

Section 2

Framework for the Economic Analysis

2.1 Introduction

The process of designating critical habitat under the ESA includes analyzing the economic, national security, and other relevant impacts of the designation. The 4(b)(2) exclusion process is conducted for a "particular area," not for critical habitat as a whole. For that reason, the analysis should be conducted at a geographic scale that divides the area under consideration into smaller subareas. The statute does not specify the exact geographic scale of these subareas, nor does it dictate the form of the economic analysis and the nature of the impacts to be included in the analysis.

This section presents the framework NOAA Fisheries is using to analyze the economic impacts of critical habitat designation. It begins by discussing this framework in broad terms. Economic analyses of regulatory actions commonly use a standard benefit-cost framework. NOAA Fisheries has chosen a framework more akin to a cost-effectiveness one; this section presents a discussion of this issue from an economic standpoint. It then outlines the 4(b)(2) process, which utilizes biological, economic, and other information. Finally, this section discusses the framework for this economic analysis, which is designed to support the 4(b)(2) process.

2.2 General Analytical Framework

When an economic activity has biological effects or other consequences for conservation, analyzing those consequences can take a number of approaches. Two possible approaches are benefit-cost analysis and cost-effectiveness analysis. Each of these approaches has strong scientific support as well as support from the Office of Budget and Management through its guidelines on regulatory analysis.⁵ Each also has well known drawbacks, both theoretical and practical, as discussed below in the context of critical habitat designation.

2.2.1 Benefit-cost analysis

Benefit-cost analysis (BCA) is the first choice for analyzing the consequences of a regulatory action such as critical habitat designation.⁶ BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits.⁷ Because BCA assesses the value of an activity in that way, however, it requires a single metric – most commonly dollars – be used to gauge both benefits and costs.

⁵ U.S. Office of Management and Budget. Circular A-4, Regulatory Analysis, September 17, 2003 (hereafter, OMB 2003).

⁶ OMB 2003.

⁷ Zerbe, R. and D. Dively, Benefit Cost Analysis in Theory and Practice, 1994.

Although the data and economic models necessary to estimate costs may be difficult and/or costly to gather and develop, expressing costs in dollars is straightforward for most regulatory actions. This is the case for critical habitat designation, which has direct impacts on activities carried out, funded, or permitted by the Federal government. In many instances, those activities must be modified to comply with section 7 of the ESA. Assessing the cost of critical habitat designation and section 7 generally, then, is mainly a task of estimating the costs and volume of the modifications.⁸

The problem of assessing the benefits of critical habitat designation in a BCA framework is also straightforward in principle but much more difficult in practice. To the extent that ESA section 7 regulations increase the protections afforded Pacific salmon and O. mykiss habitat, they produce real benefits to those species. In principle, these benefits can be measured first by a biological metric, and then by a dollar metric. A biological metric could take the form of the expected decrease in extinction risk, increase in number of spawners, increase in the annual population growth rate, and so forth. A BCA would then use this metric to assess the state of the species with and without critical habitat designation. This assessment would reveal the biological impact of designation, quantified in terms of the metric.

Preserving Pacific salmon and O. mykiss has a well-established economic value.⁹ Again, in principle, the quantified biological benefits could be evaluated in terms of willingness-to-pay, the standard economic measure of value for BCA, and the measure recommended by OMB.¹⁰ This would produce a dollar estimate of the benefits of critical habitat designation, which could then be compared directly to the costs. Evaluating a number of alternatives in this way would reveal the one with the highest net benefits (among those compared).

Translating biological benefits into dollar estimates of value is difficult and costly, however. NOAA Fisheries has used a variety of measures to gauge the viability of Pacific salmon and O. mykiss. No previous study has estimated the monetary value of these species using these measures, and so no economic data are available that would support a BCA of critical habitat designation.

2.2.2 Cost-effectiveness analysis

Recognizing the difficulty of estimating economic values in cases like this one, OMB has recently increased its emphasis on cost-effectiveness analysis (CEA) as an alternative to BCA:

⁸ There may be other types of costs, such as those generated by what are called "trigger" or "stigma" effects. While identifying and estimating the extent of these costs is difficult, the process is still straightforward. Stigma effects are discussed in the context of residential and commercial development in Section 4.3.9 of this report.

⁹ See, for example, D. Olsen, J. Richards, and R. D. Scott, Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs, *Rivers* 2(1): 44-56 (1991); J. B. Loomis, Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River: Results of a Contingent Valuation Survey, *Water Resources Research* 32(2): 441-447 (1996); and D. Layton, G. Brown and M. Plummer, Valuing Multiple Programs to Improve Fish Populations, Report to the Washington State Department of Ecology (1999).

¹⁰ Zerbe, R., and D. Dively, 1994; OMB 2003.

Cost-effectiveness analysis can provide a rigorous way to identify options that achieve the most effective use of the resources available without requiring monetization of all of [the] relevant benefits or costs. Generally, cost-effectiveness analysis is designed to compare a set of regulatory actions with the same primary outcome (e.g., an increase in the acres of wetlands protected) or multiple outcomes that can be integrated into a single numerical index (e.g., units of health improvement).¹¹

Ideally, CEA quantifies both the benefits and costs of a regulatory action but with different metrics. A common application of this method is to health care strategies, where the benefits of a strategy are quantified in terms of lives saved, additional years of survival, or some other health-related quantitative measure.¹²

Conducting a CEA of critical habitat designation would proceed along the same lines identified above for BCA, except that the last step of transforming biological benefits into economic (dollar) values would not be taken. Different configurations of critical habitat could be gauged by both metrics, with the cost-effectiveness (cost in dollars to units of biological benefits) evaluated in each case. If alternatives have the same level of biological benefits, the most cost-effective is the one with the lowest ratio of dollars to biological benefits.

Standard CEA presumes that benefits can be measured with a cardinal or even continuous measure.¹³ For critical habitat designation, however, constructing such a measure for the biological benefits is problematic. Although protecting habitat for Pacific salmon and *O. mykiss* has unquestionable benefits, it would be difficult to quantify the benefits reliably with a single biological metric given the state of the science.¹⁴ There are models for estimating numbers of salmon that might be produced from a watershed under different sets of environmental conditions.¹⁵ While such models give quantified results, the accuracy of the quantified projections is unknown because of data both on the relationships between environmental conditions and numbers of fish and the actual conditions of habitat in a given area are not available. This leads to a heavy reliance on expert opinion for estimating habitat condition and the expected response of fish to changing environmental conditions

¹¹ OMB 2003.

¹² For a full discussion of CEA in this context, see M. L. Gold, J. E. Siegel, L. B. Russell, and M. C. Weinstein, *Cost Effectiveness in Health and Medicine: The Report of the Panel on Cost-Effectiveness in Health and Medicine*, Oxford University Press, New York, 1996.

¹³ A cardinal measure has the important attribute of being susceptible to arithmetic. That is, if one object has a cardinal measure of "2", this can be compared directly to another object with a cardinal measure of "4", in that the second has "twice as much" of whatever is being measured as the first. Similarly, two objects with cardinal measure "2" would be equivalent to one object with a cardinal measure of "4."

¹⁴ *Ecosystem Recovery Planning for Listed Salmon: An Integrated Assessment Approach for Salmon Habitat*, Edited by Timothy J. Beechie, et al., Northwest Fisheries Science Center, 2003.

¹⁵ For example, see Mobrand Biometrics, Inc., *The EDT Method*, 1999.

in a specific location. Moreover, applying such models at the scale required for Pacific salmon would be time-consuming and costly. Thus, applying CEA in its standard form is not possible.

An alternative form of CEA is one that develops an ordinal measure of the biological benefits of critical habitat designation. Although it is difficult to monetize or quantify benefits of critical habitat designation, it is possible to differentiate among habitat areas based on their relative contribution to conservation. For example, habitat areas can be rated as having a high, medium or low conservation value. Like the models discussed above, such a rating is based on best professional judgment. The simpler output (a qualitative ordinal ranking), however, may better reflect the state of the science for the geographic scale considered here than a quantified output, and can be done more easily with available information. The qualitative ordinal evaluations can then be combined with estimates of the economic costs of critical habitat designation in a framework that essentially adopts that of cost-effectiveness. Individual habitat areas can be assessed using both their biological evaluation and economic cost, so that areas with high conservation value and lower economic cost have a higher priority for designation and areas with a low conservation value and higher economic cost have a higher priority for exclusion. By proceeding in order of these priorities (either in terms of inclusion or exclusion), a critical habitat designation will be formed in a manner that (in principle) minimizes or at least (in practice) reduces the overall economic cost of achieving any given level of conservation.

This form of CEA has two limitations, one of which it shares with the standard form of CEA. First, all CEAs have an important limitation when the level of benefits varies across alternatives. Because CEA does not evaluate benefits and costs in the same metric, the analysis cannot assess whether a given change has benefits that, in monetary terms, are greater than costs. Thus, while CEA is a way of minimizing the cost of achieving any given level of benefits, the analysis alone cannot specify which among a set of possible levels of benefits is the "best" choice.

A second limitation of the modified form of CEA is the inability to discern variation in benefits among those areas that have the same conservation value rank. A likely outcome is that using the modified CEA will lead to an outcome with higher expected costs of achieving any given level of conservation than one produced with standard CEA or BCA. This limitation should be compared to the greater feasibility of the modified CEA, however.

As is seen in the next part of this section, NOAA Fisheries has chosen a framework for its 4(b)(2) process that is similar to what is described as the modified form of CEA. This has implications for the economic analysis of critical habitat designation, which will be outlined following a discussion of the 4(b)(2) process.

2.3 Framework for the 4(b)(2) Process

Specific areas that fall within the definition of critical habitat are not automatically designated as critical habitat. Section 4(b)(2) (16 U.S.C. 1533(b)(1)(A)) requires the Secretary to first consider the impact of designation and permits the Secretary to exclude areas from designation under certain circumstance.

The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) of this section on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

The approach NOAA Fisheries will take to implement section 4(b)(2) involves these steps:

- Step 1: Identify specific areas meeting the definition of critical habitat
- Step 2: Conduct a section 4(b)(2) analysis:
 - ▶ Step 2.1: Determine the benefit of designation;
 - ▶ Step 2.2: Determine the impact of designation;
 - ▶ Step 2.3: Determine whether benefits of exclusion outweigh benefits of designation
 - ▶ Step 2.4: Determine whether the exclusions will result in extinction of the species.

Each of these steps is reviewed below; the descriptions have been taken from SWR 4(b)(2) report.

Step 1: Identify areas meeting the definition of critical habitat

Areas that meet the definition of critical habitat include: 1) occupied areas that contain physical or biological features essential for conservation, which may require special management considerations or protection, and 2) unoccupied areas if the area itself is essential to conservation. In a separate draft report, NOAA Fisheries has documented its conclusions regarding which specific areas meet the definition of critical habitat and are therefore eligible for designation.

In the Northwest Region (NWR), Federal, State, and Tribal fisheries biologists have made substantial progress geographically coding of the distribution of the 13 NWR ESUs. These data are accessible using fine-scale (1:24,000) geographical information systems (GIS) maps. Similar efforts have generally not been conducted in the SWR and therefore a major mapping effort was undertaken and data was compiled at the scale of 1:100,000 to delineate the “geographical area occupied by the species” referred to in the ESA definition of critical habitat.

Relying on the biology and life history of each species, NOAA determined the physical or biological habitat features essential for their conservation. Again relying on the biology and population structure of the species, and on the characteristics of the habitat it occupies, identified “specific areas” were identified in which these physical or biological features could be found. Standard watershed units, as mapped by the State of California’s CALWATER 2.2 classification system, designated by Hydrologic Sub-Area codes, or HSAs (this report refers to these HSAs as

“watersheds”) were used to delineate specific areas. Within the boundaries of any watershed, there are stream reaches not occupied by the species. Land areas within the watershed boundaries are also generally not “occupied” by the species (though certain areas such as flood plains or side channels may be occupied at some times of some years). Watershed boundaries were used as a basis for aggregating occupied stream reaches, for purposes of delineating “specific” areas.

The same watershed aggregation of stream reaches was used to analyze the impacts of designating a “particular area,” as required by section 4(b)(2). Section 3(5) defines critical habitat as being “specific areas” while section 4(b)(2) requires the agency to consider certain factors before designating “particular areas.” Depending on the biology of the species, the characteristics of its habitat, and the nature of the impacts of designation, “specific” areas might be different from, or the same as, “particular” areas. For this designation, the same delineation was used for both – the occupied stream reaches within a watershed – and referred to as a “habitat area.”

Occupied estuarine and marine areas were also considered by the agency. Estuarine areas are crucial for juvenile salmonids given their multiple functions as areas for rearing/feeding, freshwater-saltwater acclimation, and migration.¹⁶ Nearshore areas may also provide important habitat for rearing/feeding and migrating salmonids.

Step 2: Conduct a section 4(b)(2) analysis

Section 4(b)(2) provides that the Secretary shall consider certain impacts before designating critical habitat: “the Secretary shall designate critical habitat . . . on the basis of the best scientific data available and after taking into consideration the economic impact, impact to national security and any other relevant impact of specifying any particular area as critical habitat.” In addition, section 4(b)(2) provides that the Secretary may exclude any area from critical habitat upon a determination that “the benefits of such exclusion outweigh the benefits of specifying such area as critical habitat.” The balancing test in section 4(b)(2) contemplates weighing benefits that are not directly comparable – the benefit to species conservation balanced against the economic benefit, benefit to national security, or other relevant benefit that results if an area is excluded from designation. Section 4(b)(2) does not specify a method for the weighing process.

For the reasons noted in the SWR 4(b)(2) report, NOAA Fisheries has adopted a 4(b)(2) process that takes the following steps:

Step 2.1: Determine the benefit of designating each area as critical habitat

The principal benefit of designating critical habitat is that section 7 of the ESA requires every Federal agency to ensure that any action it authorizes, funds or carries out is not likely to result in the destruction or adverse modification of critical habitat. This complements the section 7 provision

¹⁶ Simenstad, C.A., K.L. Fresh, and E.O. Salo, The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. In: V. Kennedy, editor. Estuarine comparisons. Academic Press, New York, 1982, p. 343-36; and Marriott, D., and 27 contributors, Lower Columbia River and Columbia River Estuary Subbasin Summary, Report Prepared for the Northwest Power Planning Council, dated May 17, 2002.

that Federal agencies ensure their actions are not likely to jeopardize the continued existence of a listed species. Another possible benefit is that the designation of critical habitat can serve to educate the public regarding the potential conservation value of an area. This may focus and contribute to conservation efforts by clearly delineating areas of high conservation value for certain species.

After establishing those areas that meet the definition of critical habitat, NOAA Fisheries asked the teams of Federal biologists to determine the relative conservation value of each area for each species (high, medium or low). This evaluation provided information necessary to determine the benefit of designating any particular habitat area as critical habitat in a manner that would aid the 4(b)(2) balancing test. The higher the conservation value of an area, the greater the benefit of sections 7's requirements that Federal agency action not adversely modify the area.

The teams first scored each habitat area based on five factors related to the quantity and quality of the physical and biological features. They next considered each area in relation to other areas and with respect to the population occupying that area. Based on a consideration of the raw scores for each area, and a consideration of that area's contribution in relation to other areas and in relation to the overall population structure of the ESU, the teams rated each habitat area as having a "high," "medium" or "low" conservation value. The teams did not discount the conservation value of any specific area based on a presumption that the section 7 prohibition against jeopardy would protect the habitat regardless of whether it was designated as critical habitat.

Areas rated "high" are likely to contribute the most to conservation of an ESU, while those rated "low" are likely to contribute least. A rating of "high" carries with it a judgment that this area contributes significantly to conservation. A rating of "low" does not mean an area has no conservation value (and therefore there would be no benefit of designation), nor does it mean there would be no impact on conservation of the ESU if the habitat were adversely modified. The benefit of designating a habitat area with a low conservation value will depend on the reasons the area received a "low" rating, on the conservation value of other habitat areas available to the ESU, and on whether nearby habitat areas are designated.

As discussed earlier, the scale chosen for the "specific area" referred to in section 3(5)(a) was occupied stream reaches within a watershed, delineated by HSAs. (Throughout this report HSAs are referred to as watersheds, and the occupied stream reaches within a watershed as habitat areas.) There were some complications with this delineation that required NOAA Fisheries to adapt the approach for some areas. In particular, a large stream or river might serve as a migration corridor to and from many watersheds, yet be imbedded itself in a watershed. In any given watershed through which it passes, the stream may have a few or several tributaries. For migration corridors embedded in a watershed, the teams of biologists rated the conservation value of the watershed based on the tributary habitat. The migration corridor was assigned the rating of the highest-rated watershed for which it served as a migration corridor. This could result in a migration corridor with a high rating embedded in a habitat area with a low or medium rating.

The reason for this treatment of migration corridors is the role they play in the salmon's life cycle. Salmon and steelhead are anadromous – born in fresh water, migrating to salt water to feed and grow, and returning to fresh water to spawn. Without a migration corridor to and from the sea, salmon cannot complete their life cycle. It would be illogical to consider a spawning and rearing area as having a particular conservation value and not consider the associated migration corridor as having a similar conservation value.

Step 2.2: Determine the impact of designation

The economic impacts of critical habitat designation are the subject of this report. Within the framework of the 4(b)(2) process, the analysis of economic impacts is limited to impacts that are not directly related to the conservation value of the particular area (and not among the "other relevant impacts" that are also being considered). In principle, the economic analysis would still cover both economic benefits of inclusion as well as economic benefits of exclusion. The designation of critical habitat may have ancillary benefits unrelated to Pacific salmon and O. mykiss. Data on such ancillary benefits of inclusion, however, are not available at the level of the particular areas that are the focus of the 4(b)(2) process. For that reason, the economic analysis focuses on the economic benefits of a particular area being excluded from critical designation, which is referred to as the economic costs of designation.

Step 2.3: Determine whether benefits of exclusion outweigh benefits of designation

The next step is to examine areas that would be eligible for exclusion if the agency deems the economic impact to outweigh the benefit of designation. In determining whether the economic benefit of excluding a habitat area might outweigh the benefit to the species of designation, the agency will consider the following factors: 1) the policy goal of exercising its discretion to further conservation of listed species; 2) the policy goal of adopting regulations that minimize total economic impacts and disparate economic impacts; 3) the difficulty of balancing dissimilar values (dollars versus benefits to species conservation); and the limited time frame in which to make decisions. Consideration of these factors led the agency to adopt a cost-effectiveness approach (described above) in which the agency will give priority to excluding habitat areas with a relatively lower benefit of designation and a relatively higher economic impact.

The circumstances of most of the listed ESUs seem well suited to a cost-effectiveness approach. Pacific salmon and steelhead are wide-ranging species and occupy numerous habitat areas with thousands of stream miles. Most of these areas contain "physical or biological features" the agency has identified as "essential to conservation" of the ESUs. Not all these areas, however, are of equal importance to conserving an ESU, as evidenced by the biological teams' rating of different areas as high, medium or low. In many cases it may therefore be possible to construct different scenarios for achieving conservation. Scenarios might have more or less certainty of achieving conservation, and more or less economic impact.

Step 2.4: Determine whether the exclusions will result in the extinction of the species

In this final step, the agency will consider how exclusion of a particular area would affect the conservation of the ESU.

2.4 Framework for Analyzing Economic Impacts of Critical Habitat Designation

The economic analysis of the impacts of critical habitat designation follows the standard approach to regulatory analysis: The regulation under consideration changes the state of the world and any resulting changes in economic activity are then attributed to the regulation. This approach has been called the “baseline approach.”¹⁷ It does not assume the world will remain unchanged in the absence of regulation. Instead, it projects a future course of the world as a baseline, one which may involve substantial changes in economic and other conditions. It then projects another course in which the regulation has taken effect. The impacts of the regulation are then analyzed in terms of the differences between the two courses. Changes that would exist in the absence of the regulation are included in the baseline, and so do not add to the regulation’s benefits or costs.

Applying this approach to the designation of critical habitat takes the following steps:

1. Identify the baseline of economic activity and the statutes and regulations that constrain that activity in the absence of the critical habitat designation;
2. Identify the types of activities that are likely to be impacted by critical habitat designation;
3. Estimate the costs of modifications needed to bring the activity into compliance with the ESA’s critical habitat provisions;
4. Project over space and time the occurrence of the activities and the likelihood they will in fact need to be modified; and
5. Aggregate the costs up to the watershed level for each ESU.

The remainder of this section discusses each step in detail. The subsequent sections of the report give the details of how the analysis was implemented.

1. Identify the economic and statutory/regulatory baselines

The first part of identifying the baseline is to document the socioeconomic characteristics of the area covered by a critical habitat designation. Ideally, this part would include a projection of economic activity in this area over the time period under consideration. Adequate data are not available to make such projections, however, and so information is presented on the region’s current socioeconomic state.

¹⁷ This methodology is fundamental to economic analysis and not peculiar to the analysis of critical habitat designations or other forms of regulations. See U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA-240-R-00-003, September 2000.

The second part is to document existing legal and regulatory constraints on economic activity that are independent of critical habitat designation. In the case of critical habitat designation, the standard approach to regulatory analysis would describe a baseline that includes other forms of habitat protection, including those provided by other elements of the ESA. The NMCA decision, however, called this approach into question.¹⁸ In that case, the Tenth Circuit Court of Appeals called for “a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes.” Consistent with this decision, NOAA Fisheries will include the following in its analyses of the impacts of critical habitat designation:

- Co-extensive impacts, or those that are associated with habitat-modifying actions covered by both the jeopardy and adverse modification standards; and
- Incremental impacts, or those that are solely attributable to critical habitat designation and would not occur without the designation.

The economic impacts considered therefore include activities covered by the adverse modification standard of section 7 of the ESA, whether or not they are also covered by the jeopardy standard.

The laws and regulations that are considered for the baseline include the following:

- Overlapping and pre-existing CH designations;
- ESA protections for the seven Pacific salmon and O. mykiss ESUs outside section 7;
- ESA protections for other listed species; and
- Other Federal and State statutes and regulations.

In many cases, the protections afforded by these laws are intertwined with those of section 7. In cases where a clear separation can not be made, the impacts of habitat protection are attributed to the designation of critical habitat and the implementation of section 7.

2. Identify the types of activities likely impacted by critical habitat designation

Having specified the baseline economic conditions and legal/regulatory constraints, the next step is to identify the economic activity likely affected by critical habitat designation. Because section 7 directly applies only to Federal actions, the majority of impacts will be borne by Federal agencies, non-Federal parties whose federally permitted activities are altered to avoid adverse modification, and those parties that are otherwise affected by the alteration of these activities. A review of NOAA Fisheries past consultations under section 7 was undertaken to derive a set of activity types for the analysis.

¹⁸ New Mexico Cattle Growers’ Association v. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001) (following quote).

The designation of critical habitat may also trigger other impacts on non-Federal activity, however. For example, State environmental laws may contain provisions that are triggered if a State-regulated activity occurs in federally-designated critical habitat. Another possibility is that critical habitat designation could have “stigma” effects, or impacts on the economic value of private land not attributable to any direct restrictions on the use of the land. All of these types of impacts are considered in the analysis, although quantitative estimates are not always presented.¹⁹

3. Estimate the costs of the necessary activity modifications

The next step in the analysis is to estimate the cost of modifying each type of activity to bring it into compliance with section 7. Where the Federal agency’s own project is the source of the potentially harmful effect, this analysis assumes sufficient expenditures are made to make the necessary modifications. Similarly, if the activity is one that is permitted or funded by a Federal agency, this analysis assumes the non-Federal party does the same. This assumption is strong, in that there are alternatives to modifying the project and incurring those costs. The party responsible could pursue the activity in a location that does not potentially harm the species, or choose not to pursue the activity at all.

Estimating costs also involves discounting. Modifications to activities that affect Pacific salmon and O. mykiss habitat may involve costs that are spread out over time. These costs must be discounted, using standard guidance in guides such as that from the Office of Management and Budget.²⁰ In accordance with the latest guidelines, costs are evaluated using both seven percent and a three percent discount rate.

As noted above, NOAA Fisheries is analyzing both the incremental and co-extensive impacts of critical habitat designation, in accord with the NMCA decision. It is still desirable, however, to separate the two types of costs. If an impact is co-extensive and not incremental, it will occur whether or not critical habitat is designated for a particular area. Weighing the benefits of inclusion against the benefits of exclusion, then, is most easily accomplished if the focus is on incremental impacts.

The simplest case for distinguishing incremental from non-incremental impacts is when incremental impacts are (approximately) a constant proportion of the total section 7 impacts. This was the approach taken, for example in the Fish and Wildlife Service’s economic analysis of critical habitat designation for the northern spotted owl:

¹⁹ Stigma effects are discussed in the context of residential and commercial development in Section 4.3.9 of this report.

²⁰ OMB 2003.

It was further assumed, based on [Fish and Wildlife] Service consultative experience, that of the total reduction in [timber] sales, 70 percent would be due to listing impacts through application of the jeopardy standard and take prohibitions and the remaining 30 percent would be due to application of the adverse modification standard.²¹

The FWS made similar assumptions in the economic analyses for two other critical habitat designations.²²

In the case at hand, however, examination of the consultation record for Pacific salmon and steelhead provides no guidance to distinguish incremental from co-extensive impacts. Consultations that produce an outcome declaring adverse modification are exceptionally rare for these species. To see this, consider the consultation record, shown in Table 2-1, for three species of Snake River salmon (fall chinook, summer/spring chinook, and sockeye), which were listed and had critical habitat designated in the early 1990s.

The absence in the consultation record of purely adverse modification judgments does not mean that critical habitat designation has no impact. Clearly, a decision to make a final determination of either adverse modification or jeopardy is very rare. This is expected if the Federal agency undertaking the action anticipates what modifications may be needed and implements them prior to consultation. But the absence of such clear cases means that deducing the incremental impacts of critical habitat designation is difficult and is unlikely to produce the simple approach taken in previous analyses where a specific proportion is used.

Nevertheless, the consultation record for all Pacific salmon and O. mykiss does support, at least qualitatively, the conclusion that the jeopardy standard and the adverse modification standard are applied for similar actions and in similar places. If critical habitat designation supplements the application of the jeopardy standard, then the correlation in when and where they are applied suggests that the incremental impacts are roughly proportional to the total (adverse modification plus jeopardy) impacts.

If that is the case, providing information on total impacts provides useful information for the 4(b)(2) process, as long as the benefits of inclusion are judged in the same manner (that is, in terms of the total benefits of section 7, not just the incremental benefits of critical habitat protection). Both are biased upward, in that the true benefits of inclusion and of exclusion are less than the total benefits in each case. But if the incremental benefits and costs are roughly proportional to the total benefits

²¹ M.L. Schamberger, J. J. Charbonneau, M. J. Hay, and R. L. Johnson, Economic Analysis of Critical Habitat Designation Effects for the Northern Spotted Owl, 1992, pg 34.

²² D.S. Brookshire, M. McKee, and G. Watts, Draft Economic Analysis of Proposed Critical Habitat Designation in the Colorado River Basin for the Razorback Sucker, Humpback Chub, Colorado Squawfish, and Bonytail, 1993; and D.S. Brookshire, M. McKee, and C. Schmidt, Economic Analysis of Critical Habitat Designation in the Virgin River Basin for the Woundfin and Virgin River Chub, 1995.

and costs, respectively, it is still possible to ascertain, with a high likelihood, whether the benefits of inclusion are greater than the benefits of exclusion, even without knowledge of what that proportion may be.²³

4. Project the occurrence of projects and likelihood of modification

The fourth step begins by projecting the occurrence over space and time of activities that are likely to be impacted by section 7 and critical habitat designation. Projecting the occurrence of projects is not the same as projecting the occurrence of consultations and concomitant modifications, however. This analysis also considers the likelihood of a project triggering a consultation and requiring modifications. In some cases, relevant information was available on the likelihood for a specific project, while in most other cases the analysis employs assumptions about the distribution of that likelihood based on historical information or using best professional judgment.

5. Aggregate the costs for each watershed

Ideally, the estimation of the aggregate costs at the watershed level would focus on changes in consumer and producer surplus, the standard measure of regulatory impacts.²⁴ This is in keeping with the guidance of the Office of Management and Budget and in accord with E.O. 12866.²⁵

The fact that data to support such an analysis are not available and the geographic scope of the designations make this approach impractical. A simpler approach provides an acceptable alternative under a robust set of circumstances. In cases where the scale of activity in a watershed is "small," the aggregate costs of modifications approximates the change in economic surplus. A "small" scale is one that does not (significantly) affect the market for the goods and services associated with the type of project or action. With few exceptions, the projects and actions covered in this analysis appear to meet this standard.

Our basic approach, then, is to estimate aggregate costs by using the per-project modification cost and the forecast volume of projects in a watershed to calculate a total cost for that activity and watershed. This method does not allow for more dynamic responses to section 7 (for example, relocating activities or changing their frequency or timing) but will be a good approximation of the true impacts under most circumstances.

Our framework assumes that the per-project costs are not affected by the amount of critical habitat designated for an ESU (or across ESUs). This is in accord with the focus of the analysis on a single unit (a watershed), implicitly assuming that no other units have been designated. Yet as areas are in fact designated, economic impacts may accumulate and market-level effects may become

²³ Simply put, if $P \times X > P \times Y$, then $X > Y$. Information on the relative sizes of total impacts (that is, $10 \times X$ and $10 \times Y$) thus provides useful information about the relative sizes of the incremental impacts (X and Y), even without information on the factor of proportionality (that is, P).

²⁴ EPA 2000; and OMB 2003.

²⁵ OMB 2003.

significant. This may then affect the costs (and benefits) of additional inclusions. For example, if critical habitat designation restricts the supply of a good in more than one area, the magnitude of the restriction's impact on a particular area may depend on the amount of critical habitat designated overall.

Another complication concerns the attribution of the impacts of critical habitat designation to an individual watershed. A large project may have biological effects that extend downstream, beyond the boundaries of the watershed within which it is located. If this is the case, the designation of a watershed other than the project's home watershed can nevertheless have impacts on that project. For example, a major hydropower project can have biological effects tens or even hundreds of miles downstream. Designating any one of the downstream watersheds would be sufficient to force at least some modifications on the project. The incremental impact of designating more than one downstream watershed would be significantly less than the incremental impact of designating the "first " watershed. This makes it difficult conceptually to attribute the impacts of designation to a particular area, as there is no basis for identifying one watershed among many as the "first" to be designated.

2.5 Summary

The economic framework used in this report is a straightforward one, summing project-level impacts to estimate the total impact of designating a watershed as critical habitat. Limitations in this framework are noted, and more are considered for each activity in Section 4. Even with the limitations, the framework produces information that will allow the 4(b)(2) process to distinguish between areas that have a "high" benefit of exclusion and those that have a "low" benefit of exclusion. This information will support a cost-effective approach to designating critical habitat.

Section 3

Baseline Information

3.1 Introduction

This section provides information on the economic, legal, and regulatory baselines for the economic analysis. The seven ESUs in California intersect 46 counties. These ESUs are protected by a complex web of other Federal, State, and local laws and regulations. This section begins with a brief overview of the geographic scope of the designations, and then discuss first the economic baseline and then the legal and regulatory baseline.

3.2 Geographic Scope of the Critical Habitat Designations

The critical habitat areas under consideration for the seven ESUs of Pacific salmon and O. mykiss in California cover over 23 million acres. The Map Appendix of this report shows the HSA watersheds and nearshore areas for all seven ESUs combined (Figure 1) and for each individual ESU (Figures 2 - 8). These watersheds constitute the "particular areas" or the geographic units of analysis for this report. Table 3-1 below lists the number of watersheds by State for each ESU, while Table 3-2 lists the average and range of the watersheds' size for each ESU. Appendix A lists the watersheds in each ESU and gives the watershed and subbasin names. It is noted here and considered in more detail later that a watershed may be considered for designation in more than one ESU.

As illustrated in these figures, the geographic scope of the critical habitat designations and the number of watersheds are quite large. For this reason, this analysis discusses issues such as the baselines (see below) and the methods used in the analysis (see Section 4 of this analysis) in the body of the report, but the bulk of the results of the economic analysis is presented in a series of appendices.

3.3 Economic Baseline

In presenting baseline information on the economic characteristics of the watersheds in the seven ESUs, this analysis faces a classic problem: ecological and economic boundaries do not coincide. Census information is available at the County (or metropolitan area) level, but a County may be covered by several watersheds, and this coverage varies widely, as Figures 2 through 8 illustrate. Describing economic activity at the level of the entire County may be misleading, however, as the watersheds considered for critical habitat designation may only cover a small part of the County. For example, three counties in California have less than five square miles in critical habitat areas being considered for one or more ESUs. Describing a baseline in terms of the socioeconomic characteristics of these counties would not be representative of the true baseline.

Table 3-1 NUMBER OF OCCUPIED WATERSHEDS BY ESU	
ESU	Watersheds
California Coastal chinook salmon	47
Central Valley spring-run chinook salmon	37
Central California Coast <u>O. mykiss</u>	47
California Central Valley <u>O. mykiss</u>	67
Northern California <u>O. mykiss</u>	52
South-Central California Coast <u>O. mykiss</u>	30
Southern California <u>O. mykiss</u>	37
Notes: The sum of the number of watersheds in each ESU may exceed the actual number of watershed proposed as some watersheds are proposed for designation for more than one ESU.	

One way to present a more accurate economic picture of the ESUs and their constituent watersheds is to apportion a County's economic activity between the area within the County being considered for critical habitat designation and the area that is not being considered. Using the size of each area would necessarily assume that the density of economic activity is uniform throughout a County, an assumption that is untenable. A strong but more palatable assumption is that economic activity per-capita is constant throughout a County. Estimating the population within watershed then provides the basis for estimating economic activity at the watershed level. If the watersheds under consideration cover only part of a County, this approach produces a more accurate picture of the potential impacts on that County.

Table 3-2 SIZE OF OCCUPIED WATERSHEDS BY ESU			
ESU	Size of watershed (square miles)		
	Average	Maximum	Minimum
California Coastal chinook salmon	158	413	3
Central Valley spring-run chinook salmon	219	1,074	15
Central California Coast <u>O. mykiss</u>	126	635	15
California Central Valley <u>O. mykiss</u>	206	1,074	6
Northern California <u>O. mykiss</u>	133	413	3
South-Central California Coast <u>O. mykiss</u>	197	1,495	3
Southern California <u>O. mykiss</u>	118	1,145	1.0

Using spatial data on County and watershed boundaries and on U.S. Census block data from the 2000 census, the population of each watershed is estimated, and for each County-watershed intersection. From these, the proportion of each counties population that lives in an area being considered for critical habitat designation is determined. By applying the assumption of uniform per-capita economic activity throughout a County, estimates of economic activity in that portion of a County potentially impacted by critical habitat are derived.

Demographic and economic information is presented in both forms: for the County as a whole and for the portion of the County's population estimated to be in watersheds covered by the ESU. Tables 3-3 and 3-4 summarize this information on an ESU-basis. In each case, this analysis presents a figure that sums over all the counties covered by an ESU by including the entire County, and then one that sums over all the counties in an ESU by including only that portion covered by the ESU. Appendix B provides the same information for each County individually, while Appendix C provides this information (and more) at a watershed level, using the estimation procedure discussed above .

Table 3-3
DEMOGRAPHICS FOR COUNTIES AND ESUS

ESU	Population		Area (sq. miles)		Population Density	
	Counties	ESU	Counties	ESU	County	ESU
California Coastal chinook salmon	968,303	428,651	19,461	7,417.00	49.8	57.8
Central Valley spring-run chinook salmon	6,257,268	1,757,987	31,338	7,704	199.7	228.2
Central California Coast <u>O. mykiss</u>	9,418,030	5,741,401	16,278	5,483	578.6	1,047.1
California Central Valley <u>O. mykiss</u>	7,818,201	3,041,659	49,432	13,415	158.2	226.7
Northern California <u>O. mykiss</u>	844,024	169,718	18,673	6,880	45.2	24.7
South-Central California Coast <u>O. mykiss</u>	4,096,822	701,525	19,265	5,892	212.7	119.1
Southern California <u>O. mykiss</u>	18,785,717	784,002	32,514	4,350	577.8	180.2

Table 3-4
INCOME AND EMPLOYMENT FOR COUNTIES AND ESUS

ESU	Personal Income (\$1000)		Total Employment	
	Counties	ESU	Counties	ESU
California Coastal chinook salmon	30,164,000	13,066,000	550,174	248,362
Central Valley spring-run chinook salmon	200,507,000	50,141,000	3,405,202	956,998
Central California Coast <u>O. mykiss</u>	395,433,000	274,221,000	6,048,254	3,909,824
California Central Valley <u>O. mykiss</u>	238,194,000	80,952,000	4,179,904	1,547,107
Northern California <u>O. mykiss</u>	25,462,000	4,048,000	466,207	94,504
South-Central California Coast <u>O. mykiss</u>	153,749,000	23,298,000	2,523,835	406,373
Southern California <u>O. mykiss</u>	571,651,000	26,393,000	10,870,809	478,011

3.4 Statutory and Regulatory Baseline

There are two broad types of legal and regulatory restrictions that can protect habitat even in the absence of critical habitat designation. The first is other parts of the ESA, including critical habitat designations for Pacific salmon and O. mykiss ESUs not covered by this proposal. The second is a law or regulation that protects habitat, whether or not that is its intent, and operates independently of the ESA. Both of these are discussed below.

3.4.1 ESA habitat protections other than Section 7

In the current state of the world, where critical habitat is not designated for the seven ESUs, the ESA can still protect habitat in three ways:

1. ESA sections other than section 7 for the seven ESUs;
2. Existing critical habitat designations for other Pacific salmon and O. mykiss that pre-date this proposal; and
3. ESA protections for non-salmon and non-O. mykiss species where the habitat for those other species overlaps the habitat for the seven ESUs and these protections provide ancillary benefits for Pacific salmon and O. mykiss.

Absent section 7 protections, Pacific salmon and O. mykiss habitat may still be protected by other parts of the ESA. For example, section 9's prohibition against "take" can curtail economic activity in an area occupied by a listed species. If there is no Federal nexus – the Federal government does not carry out, fund, or issue a permit for the activity – section 7 does not apply but the species and its habitat are still protected. The impacts engendered by section 9 and sections of the ESA other than section 7 are therefore included in the baseline and not considered in the analysis.

Similarly, restrictions on Federal activities that jeopardize a listed species in ways that avoid modifying habitat are also embedded in the baseline. For example, in the seven ESUs under consideration, NOAA Fisheries has conducted consultations over the past few years for activities such as harvest and hatchery operations, which may harm the species but not by modifying its habitat. Although the ESA may have substantial impacts on these activities, they are not related to section 7's constraints on habitat modification, and so are included in the baseline and not considered in the analysis.

A more challenging example is hydropower operations. The operation of hydropower dams can adversely modify spawning, rearing, and migratory habitat, but it can also directly harm Pacific salmon and O. mykiss by increasing mortality as the fish pass through a dam's turbines. Modifications that address the first set of effects properly fall within the scope of the economic analysis, while modifications that address the second set of effects belong, in principal at least, in the baseline. Distinguishing the effects of hydropower operations in this way, however, is not

possible with the data available, and so all hydropower modifications are included in the analysis. This may result in an overestimate of the impacts of critical habitat.

A second source of habitat protection under the ESA stems from the fact that individuals from different ESUs may occupy the same geographic area, so that protecting habitat for one ESU may conserve the habitat of another ESU. This presents two issues for the establishment of the baseline, depending on whether the overlap is between new and existing areas or between new critical habitat areas.

The first case is for an overlap between the proposed designations and existing designations for Pacific salmon ESUs that are not part of this proposal. Given the uncertainty that these existing designations will remain in place in their current configuration, they are not included in the baseline. Moreover, because of the cost-effectiveness framework, so long as these designations are not also counted as part of the baseline when NOAA considers the benefit of designation for each ESU, this analysis will still present an accurate picture of the benefits of designation versus the benefits of exclusion.

Overlap also exists among the ESUs that are under consideration. The resolution of this issue is more complicated. Ideally, where critical habitat proposals overlap and afford similar (but not necessarily identical) protections, the analysis should consider the designations jointly. When actions take place simultaneously, there is no way to assign economic effects individually unless there is a logical or some other ordained order for the actions. If that is the case, an alternative is to analyze them sequentially: The effects of the "first" designation would be analyzed under an initial set of baseline conditions, and then any overlapping designations would be analyzed using a baseline that included the prior designation(s). This is not possible for the Pacific salmon and O. mykiss ESUs, however, as NOAA Fisheries is proposing to designate them as a package.

Because none of the seven ESUs has critical habitat designated in the current state of the world, and because the probability exists (from the point of view of this analysis) that critical habitat in fact may not be designated for certain watersheds, this analysis applied the following assumption: Where two or more of the ESUs under consideration overlap in terms of proposed critical habitat, the protections afforded by designating critical habitat for one ESU are not included in the baseline for the analysis of the impacts of the other ESUs.

Finally, other species listed under the ESA may occupy the same geographic area as Pacific salmon and O. mykiss, and thereby afford some protection to the latter's habitat. To the extent that the ESA protections for these species provide ancillary benefits to Pacific salmon and O. mykiss, those benefits should be included in the baseline.

A fundamental problem in incorporating these benefits into the baseline, however, is that they depend on the status of a species other than Pacific salmon and O. mykiss. If the status of that species improves, critical habitat could be revised but not based on any consideration of the status of Pacific salmon and O. mykiss. For that reason, this analysis does not generally consider these benefits to be part of the baseline.

3.4.2 Other laws and regulations that protect habitat

Federal laws other than the ESA, and State and local laws and regulations may protect Pacific salmon and O. mykiss habitat in the absence of critical habitat designation. While these protections may not be as strong as those under section 7, they should still be included in the baseline. In many cases, a law or regulation directly affects an activity that also has the potential to adversely modify Pacific salmon and O. mykiss habitat. In those cases, this analysis incorporates the economic impacts of these other measures into the baseline, in that it does not consider them even if section 7 also covers them. In other cases where the link is less clear or direct, this analysis adopts a conservative stance and assumes that the effects of the law or regulations and those of critical habitat designation do not overlap.

Below, the major sources of legal and regulatory baseline protection are discussed in terms of their relevance to the analytical baseline. The "baseline status" notation is as follows:

- **Baseline status: No.** This analysis explicitly considered this regulation in terms of its potential to offer baseline protection to the species, and determined that the regulation should not be assigned baseline status because: (1) its provisions for the protection of Pacific salmon and O. mykiss habitat were historically reinforced through section 7 consultation, and therefore considered to be coextensive with section 7; or (2) while the regulation encouraged behavior to protect Pacific salmon and O. mykiss habitat, it did not explicitly require these protections by law.
- **Baseline status: Partial.** Certain protections for the species and habitat provided by this regulation are considered baseline; other protections are not. Using the Clean Water Act as an example, compliance with current water quality standards are considered to be baseline protections for the species and habitat. In contrast, explicit consideration of Pacific salmon and O. mykiss associated with section 404 permitting, which requires a section 7 consultation, is considered to be a protection associated with the designation of critical habitat.
- **Baseline status: Yes.** The protections provided by this regulation to Pacific salmon and O. mykiss habitat are incorporated into the baseline, as the impacts would occur without section 7 consultation and therefore not included in our cost assessment.

This section also lists other laws and regulations that may constrain habitat-modifying Federal actions but are unlikely to provide significant protection.

Clean Water Act (33 U.S.C. 1251 et seq. 1987)

Baseline status: Partial

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States. It gives the Environmental Protection Agency (EPA) the authority to implement pollution control programs such as setting wastewater standards for industry. The CWA also continued requirements to set water quality standards for all contaminants in surface waters.

According to the CWA, it is unlawful for any person to discharge a pollutant from a point source into navigable waters, unless a permit is obtained under its provisions; this requires issuance of Section 404 permits from the USACE. As part of pollution prevention activities, the USACE may limit activities in waterways through its 404 permitting process, independent of salmon concerns. These reductions in pollution may benefit Pacific salmon and O. mykiss.

Under the National Pollutant Discharge Elimination System (NPDES) program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply to these limits.

Under the water quality standards program, EPA, in collaboration with States, establishes water quality criteria to regulate ambient concentrations of pollutants in surface waters. Under section 401 of the CWA, all applicants for a Federal license or permit to conduct activity that may result in discharge to navigable waters are required to submit a State certification to the licensing or permitting agency.

This analysis includes NOAA Fisheries's recommended modifications (as described in biological opinions) to USACE permit applications to be a section 7 impact. To the extent that NOAA Fisheries recommendations overlap with USACE's planned actions under CWA, then this analysis may overstate the impact of section 7 impacts. In addition, it includes impacts related to water temperature control requirements implemented through the NPDES program. Other potential CWA protections that are not reinforced through section 7 (e.g., as project modifications in biological opinions) are considered baseline protections.

National Forest Management Act (16 USC §§ 1600-1614 1976)

Baseline status: Partial

This Act requires assessment of forest lands, development of a management program based on multiple-use, sustained-yield principles, and implementation of a resource management plan for each unit of the National Forest System. The Act may provide protection to Pacific salmon and O. mykiss

within National Forests, primarily through its authorization of the Northwest Forest Plan (NWFP) and PACFISH. NWFP and PACFISH provide numerous protections for salmon species related to Federal lands management activities (The NWFP and PACFISH are discussed in more detail below).

As stated below, this analysis considers NOAA Fisheries recommended alterations (as described in biological opinions) to planned USFS and BLM actions in these areas to be a section 7 impact. To the extent that NOAA Fisheries recommendations overlap NWFP provisions, this analysis may overstate the impact of section 7 implementation for Pacific salmon and O. mykiss. NWFP protections that are not reinforced through section 7 (e.g., as project modifications in biological opinions) are considered baseline protections.

Northwest Forest Plan (1994)²⁶

Baseline status: Partial

The Northwest Forest Plan defines Standards and Guidelines (S&Gs) for forest use throughout the 24 million acres of Federal lands in its planning area (the range of the Northern spotted owl, Western Oregon, Western Washington, and Northwestern California). Specifically, the NWFP provides S&Gs for management of timber, roads, grazing, recreation, minerals, fire/fuels management, fish and wildlife management, general land management, riparian area management, watershed and habitat restoration, and research activities on USFS and BLM lands. To accomplish its goals, the NWFP defines seven land allocation categories, including “matrix lands,” areas where the majority of timber is to be taken, and Riparian Reserves and Key Watersheds, where distances from rivers are set within which many activities are restricted. The Aquatic Conservation Strategy (ACS) component of the plan specifically provides for fishery habitat, protection, and restoration.

All Federal lands management activities in the NWFP planning area are affected by the Northwest Forest Plan. As a result, some projects that would have affected salmon habitat will not be proposed, and therefore will not be subject to section 7 implementation. These changes in projects are considered baseline and are not included as a cost of section 7 in this analysis. For section 7 consultations that do occur, they may include project modifications that would already have occurred under the NWFP. These modifications are nevertheless included in this analysis as section 7 impacts. As a result, this analysis may overstate the costs of section 7 implementation for Pacific salmon and O. mykiss.

²⁶ NOAA Fisheries and the Fish and Wildlife Service recently clarified their application of section 7 to the Northwest Forest Plan. See Record of Decision, Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy, U.S. Department of Agriculture, Forest Service, and U.S. Department of the Interior, Bureau of Land Management, March 2004.

PACFISH (Interim strategies for managing anadromous fish-producing watersheds) (1995)
Baseline status: Partial

For anadromous fish-producing watersheds on Federal lands in eastern Oregon, Washington, Idaho and Northern California that are not covered by the Northwest Forest Plan (NWFP), USFS and BLM adopted a management strategy to arrest the degradation and begin the restoration of anadromous fish protection. This strategy was intended to be in place only for 18-months, beginning in February of 1995, but continues to be implemented.

Like the NWFP, PACFISH provides guidelines for timber, roads, grazing, recreation, minerals, fire/fuels management, lands, riparian area, watershed and habitat restoration, and fisheries and wildlife restoration. Standards and guidelines under PACFISH are nearly identical to those in the NWFP.

Federal lands management activities in the NWFP planning area are affected by PACFISH. As a result, some projects that would have affected salmon habitat will not be proposed, and therefore will not be subject to section 7 implementation. These changes in projects are considered baseline and are not included as a cost of section 7 in this analysis. For section 7 consultations that do occur, they may include project modifications that would already have occurred under PACFISH. These modifications are nevertheless included in this analysis as section 7 impacts. As a result, this analysis may overstate the costs of section 7 implementation for Pacific salmon and O. mykiss.

Federal Power Act (16 U.S.C. § 800 1920, as amended)
Baseline status: No

The Federal Power Act (FPA) was promulgated to establish a regulatory agency to oversee non-Federal hydropower generation. The resulting Federal Energy Regulatory Commission (FERC), an independent Federal agency governing approximately 2,500 licenses for non-Federal hydropower facilities, has responsibility for national energy regulatory issues.

This Act may provide protection to Pacific salmon and O. mykiss habitat from hydropower activities. Section 10(j) of the Federal Power Act (FPA) was promulgated to ensure that FERC considers both power and non-power resources during the licensing process. More specifically, section 18 of the FPA states that FERC shall require the construction, operation, and maintenance by a licensee at its own expense of a fishway if prescribed by the Secretaries of Interior (delegated to the Fish and Wildlife Service) and Commerce (NOAA).

The recommendation to install or improve a fish ladder may be brought about through consultation under section 7 of the ESA or through the FPA. In the absence of information on which regulation may serve as the causative factor, this analysis considers the cost of these modifications as section 7 impacts.²⁷

Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-666 1934, as amended)

Baseline status: No

This regulation provides that, whenever the waters or channels of a body of water are modified by a department or agency of the U.S., the department or agency first shall consult with the U.S. Fish and Wildlife Service and with the head of the agency exercising administration over the wildlife resources of the State where modification will occur with a view to the conservation of wildlife resources.

The purpose of this Act is to ensure that fish and wildlife resources are equally considered with other resources during the planning of water resources development projects by authorizing NOAA Fisheries to provide assistance to Federal and State agencies in protecting game species and studying the effects of pollution on wildlife. This Act may offer protection to Pacific salmon and O. mykiss habitat by requiring consultation concerning the species with NOAA Fisheries for all in-stream activities with a Federal nexus.

This analysis assumes that NOAA Fisheries's recommendations to Federal agencies through consultation under the FWCA are the same, or similar, to those provided through section 7 for Pacific salmon and O. mykiss. As a result, recommendations generated from FWCA are considered to be coextensive with section 7, and these costs are included in this analysis.

Rivers and Harbors Act (33 USC §§ 401 et seq. 1938)

Baseline status: Partial

The Rivers and Harbors Act (RHA) places Federal investigations and improvements of rivers, harbors and other waterways under the jurisdiction of the Department of the Army, U.S. Army Corps of Engineers (USACE) and requires that all investigations and improvements include due regard for wildlife conservation.

²⁷ This is a strong assumption, as there is evidence for particular dams that the application of the FPA alone has the ability to impose substantial modifications on FERC-licensed projects that benefit Pacific salmon and O. mykiss (Interview, Source TK). NOAA Fisheries has not yet considered this possibility comprehensively – that is, for every FERC-licensed project in each ESU. For that reason, this draft analysis categorized modifications that may be attributable to the FPA as not being part of the baseline. As a result, this analysis may overstate the costs of section 7 implementation for Pacific salmon and O. mykiss.

This Act may provide protection to the Pacific salmon and O. mykiss from in-stream construction activities. Under sections 9 and 10 of the RHA, the USACE is authorized to regulate the construction of any structure or work within navigable water. This includes, for example, bridges and docks.

To the extent that NOAA Fisheries's recommendations through section 7 overlap USACE regulated provisions for Pacific salmon and O. mykiss according to the RHS, this analysis overstates the impact of section 7 implementation for Pacific salmon and O. mykiss. RHA protections that are not reinforced through section 7 (e.g., as project modifications in biological opinions) are considered baseline protections.

National Environmental Policy Act (42 USC §§ 4321-4345 1969)

Baseline status: No

The National Environmental Policy Act (NEPA) requires that all Federal agencies conduct a detailed environmental impact statement (EIS) in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.

The NEPA process may provide protection to the Pacific salmon and O. mykiss for all activities that have Federal involvement, if alternatives are considered and selected that are less harmful to salmon and its habitat than others. For this analysis, however, NEPA provisions are not considered as a baseline element.

Wilderness Act (16 USC §§ 1131-1136 1964)

Baseline status: Yes

The Wilderness Act established the National Wilderness Preservation System. With a few exceptions, no commercial enterprise or permanent road is allowed within a wilderness area. Temporary roads, motor vehicles, motorized equipment, landing of aircraft, structures and installations are only allowed for administration of the area. Measures may be taken to control fire, insects and disease. Prospecting for mineral or other resources, if carried on in a manner compatible with the preservation of wilderness, is allowed.

The Wilderness Act may offer protections to Pacific salmon and O. mykiss by limiting land disturbing activities in Wilderness Areas in National Forests. Human activity in wilderness areas is likely to be greatly reduced when compared to non-wilderness areas, which is likely to benefit salmon. As explained in the next section, this analysis used Schedules of Planned Actions (SOPAs) from National Forests to determine expected activity levels in the future. To the extent that Wilderness Area designations have precluded human activity and plans for activity in critical habitat, then Wilderness Area impacts are incorporated into the baseline.

The Sikes Act Improvements Act (16 USC §670 1997)

Baseline status: N/A

The Sikes Improvement Act (SIA) requires military installations to prepare and implement an Integrated Natural Resources Management Plan (INRMP). The purpose of the INRMP is to provide for:

- The conservation and rehabilitation of natural resources on military installations;
- The sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and nonconsumptive uses; and
- Subject to safety requirements and military security, public access to military installations to facilitate the use of the resources.

INRMPs developed in accordance with SAIA may provide protection to the Pacific salmon and O. mykiss habitat on military lands.

The recent National Defense Authorization Act for Fiscal Year 2004 (Public Law No. 108-136) amended the ESA, affecting areas eligible for designation as critical habitat. Specifically, section 4(a)(3)(B)(I) of the ESA (16 U.S.C. 1533(A)(3)) provides that: "The Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation." The Act also added "national security" as an impact to be considered in the 4(b)(2) process.

NOAA Fisheries has contacted the Department of Defense for information on DOD INRMPs and the benefits they might afford Pacific salmon and O. mykiss, as well as the potential impacts on national security of the designations. These two areas are considered in a separate report, and therefore any impacts from the Sikes Act are not considered in this analysis, but will play a role in the 4(b)(2) process.

Long-Term Management Strategy (LTMS) For the Placement of Dredged Material in the San Francisco Bay Region

Baseline status: Yes

The LTMS is a multi-agency effort on the part of the U.S. Army Corps of Engineers (USACE), EPA, NOAA and others to eliminate unnecessary dredging and maintain in an economically and environmentally sound manner those channels necessary for navigation in San Francisco Bay and Estuary. The LTMS considered three long-term strategies for channel maintenance, all of which

attempt to reduce the amount of sediment disposed within the San Francisco Bay estuary. The LTMS also establishes dredging windows for salmon and other aquatic species. Seasonal limitations on dredging were established to accommodate salmon spawning.

NOAA reviews USACE dredging permit applications at the programmatic level, as opposed to the individual permit level, unless projects cannot occur within the allotted dredging windows and a formal consultation is required. Based on historical project experience, this is expected to occur approximately 14 percent of the time. As dredging project windows and establishment of appropriate disposal sites are required by the LTMS, these potential project modifications are considered baseline protection for the salmon and O. mykiss.

California Environmental Quality Act (CEQA) (California Natural Resources Code §15065(a))
Baseline Status: No

CEQA is a California State statute that requires State and local agencies (known as “lead agencies”) to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Projects carried out by Federal agencies are not subject to CEQA provisions. CEQA instructs the lead agency (typically a county or city community development or planning department in the case of land development projects) to examine impacts from a broad perspective, taking into account the value of species’ habitats that may be impacted by the project in an Environmental Impact Report (EIR). The lead agency must determine which, if any, project impacts are potentially significant and, for any such impacts identified, whether feasible mitigation measures or feasible alternatives will reduce the impacts to a level less than significant. It is within the power of a lead agency to decide that negative impacts are acceptable in light of economic, social, or other benefits generated by the project.

Where listed species are present on the project site, the EIR’s biological component is required to discuss and evaluate habitat impacts, as well as present project alternatives. This requirement is unchanged after Federal designation of critical habitat; CEQA makes no reference to critical habitat. This analysis does not quantify compliance with CEQA and, as Federal agencies are not subject to CEQA, does not consider this State regulation to offer significant baseline protection to the salmon and O. mykiss.

Other statutes and regulations that apply to land use activities

While the following statutes and regulations may apply to the land within an ESU, they are unlikely to provide significant baseline protection and are not considered in the analysis.

Fish and Wildlife Conservation Act (16 USC §§ 2901-2911 1980, as amended) – The FWCA encourages States to develop, revise and implement, in consultation with Federal, State, local and regional agencies, a plan for the conservation of fish and wildlife, particularly species indigenous to the State.

Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1882 1976, as amended) – This regulation requires identification of essential fish habitat in fishery management plans and consideration of actions to ensure the conservation and enhancement of habitat.

Fisheries Restoration and Irrigation Mitigation Act (16 USC § 777 2000) - The FRIMA directs the Secretary of Interior, in consultation with the heads of other appropriate agencies, to develop and implement projects to mitigate impacts to fisheries resulting from the construction and operation of water diversions by local government entities (including soil and water conservation districts) in the Pacific Ocean drainage area.

Water Resources Development Act (33 USC §§ 2201-2330 1986, as amended) - WRDA authorizes the construction or study of USACE projects and outlines environmental assessment and mitigation requirements.

Anadromous Fish Conservation Act (16 USC §§ 757 et seq. 1965) - The AFCA authorizes the Secretary of the Interior to enter into agreements with States and other non-Federal interests to conserve, develop and enhance the anadromous fish resources of the U.S.

Wild and Scenic Rivers Act (16 USC §§ 1271-1287 2001) - WSRA authorizes the creation of the National Wilderness Preservation System and prohibits extractive activities on specific lands.

North American Wetland Conservation Act (16 USC § 4401 et seq. 1989) - NAWCA encourages partnerships among public agencies and other interests to protect, enhance, restore and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife.

Federal Land Policy and Management Act (43 USC §§ 1701-1782 1976) – This Act requires the Bureau of Land Management to employ a land planning process that is based on multiple use and sustained yield principles

Executive Order 11988 and 11990 (1977) – These Executive Orders require, to the extent possible, prevention of long and short term adverse impacts associated with the occupancy and modification of floodplains and prevention of direct or indirect support of floodplain development wherever there is a practicable alternative.

Coastal Zone Management Act (16 USC §§ 1451 et seq. 1972) - CZMA establishes an extensive Federal grant program to encourage coastal States to develop and implement coastal zone management programs to provide for protection of natural resources, including wetlands, flood plains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitat.

California Endangered Species Act (California Fish and Game Code §§ 2050, et seq.) - The CESA parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (DFG). CESA prohibits the "taking" (the California Fish and Game Code defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill") of listed species except as otherwise provided in State law. The CESA also applies the take prohibitions to species petitioned for listing ("candidate species").

Z'berg-Nejedly Forest Practice Act of 1973 (Cal. Pub. Res. Code §§ 4511 - 4628) - Also referred to as the California Forest Practice Act, this act regulates all timber harvesting in California on all non-federal land. CDF oversees enforcement of California's forest practice regulations. Under the Forest Practice Act, Timber Harvesting Plans (THPs) are submitted to CDF for commercial timber harvesting on all non-federal timberlands. The Act requires that all private forest land be replanted within five years and that a certain number of dead trees be left in harvest areas for birds and animals that need them.

Section 4

The Impacts of Section 7 on Habitat-Modifying Activities

4.1 Introduction

This section presents the estimated impacts of section 7 on an activity that may affect Pacific salmon and O. mykiss by modifying habitat. It first discusses the consultation history of the seven Pacific salmon and O. mykiss ESUs, then presents the types of activities included in the analysis and the modifications typically needed to comply with section 7. For each type of activity, this section summarizes the expected costs of these modifications and the methods used to project the activity's occurrence over space and time. Section 5 presents estimates of aggregate impacts at the watershed level. Appendix D gives a more detailed discussion of our methods for estimating impacts.

4.2 Consultation History

NOAA Fisheries has compiled an extensive history of consultations for the seven ESUs of Pacific salmon and O. mykiss under consideration since the listings of these ESUs in the 1990's. The database for these seven ESUs indicates that from 2000 to 2003,²⁹ the SWR of NOAA Fisheries engaged in over 1,098 consultation and technical assistance efforts, involving roughly 30 different Federal agencies, most notably the Army Corps of Engineers (657 consultations), Federal Highway Administration (137), and Forest Service (79). About ten percent of the consultations were formal and about 64 percent were informal.³⁰ The remainder consisted of pre-consultation and technical assistance (16 percent), and other types of consultations not specified (ten percent).

Table 4-1 provides more detailed information on the consultation history. This section first lists the Federal agencies that have been most often involved in salmon and/or O. mykiss consultation during 2000-2003.

²⁹ Approximately 97 percent of the consultations in the database occurred between 2000-2003. The database is incomplete for earlier years.

³⁰ A formal consultation involves the issuance of a biological opinion and incidental take statement by either of the Services. If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required (except when the Services concur, in writing, that a proposed action "is not likely to adversely affect" listed species or designated critical habitat). [50 CFR §402.02, 50 CFR §402.14]. An informal consultation is an optional process that includes all discussions and correspondence between the Services and a Federal agency or designated non-Federal representative, prior to formal consultation, to determine whether a proposed Federal action may affect listed species or critical habitat. This process allows the Federal agency to utilize the Services' expertise to evaluate the agency's assessment of potential effects or to suggest possible modifications to the proposed action which could avoid potentially adverse effects.

This consultation history provides a rich source of information on the types of activities that are likely to be affected by critical habitat designation.³¹ Table 4-2 lists types that have been the subject of five or more consultations during 2000-2003, along with the number of consultations for that type of action.³² The most common type of activity covered in the consultation record was bridge repair or construction (142), followed by bank stabilization (95), breakwater, dock, or pier projects (91 consultations), road construction or maintenance (89), dredging (82), and habitat restoration or improvement projects (61).

4.3 Types of Activities

The following set of activity types for the economic analysis was derived from the consultation record:

- Hydropower dams;
- Non-hydropower dams and other water supply structures;
- Federal lands management, including grazing (considered separately);
- Transportation projects;
- Utility line projects;
- Instream activities, including dredging (considered separately);
- EPA NPDES-permitted activities;
- Sand & gravel mining; and
- Residential and commercial development.

This set does not cover all possible activities but covers both the majority of consultations and a high proportion of the impacts. Each of these types is discussed below.

³¹ Consultations are not the only source of information, of course, because direct impacts through section 7 consultations are not the only source of critical habitat designation and section 7 impacts. As described in section II, impacts from other laws or regulations may be triggered by the designation, or the designation may have so-called "stigma" effects. The section 7 consultation record will not provide information to document these types of impacts.

³² A single consultation can include multiple types of activities.

Table 4-1 FEDERAL AGENCIES INVOLVED IN 10 OR MORE PACIFIC SALMON AND <u>O. MYKISS</u> CONSULTATIONS IN THE SWR	
Federal Agency	Number of Consultations
Corps of Engineers	657
Federal Highway Administration	137
Forest Service	79
Bureau of Reclamation	40
Fish and Wildlife Service	27
Bureau of Land Management	24
Army Department	22
National Park Service	18
Natural Resource Conservation Service	16
Federal Emergency Management Agency	11
National Oceanic Atmospheric Administration	10

Table 4-2 ACTIONS INVOLVED IN PACIFIC SALMON AND <u>O.</u> <u>MYKISS</u> CONSULTATIONS WITH GREATER THAN FIVE CONSULTATIONS IN THE SWR	
Type of Action	No. of Consultations
Bridge Repair/Construction	142
Bank Stabilization	95
Breakwater/Dock/Pier	91
Road Construction/Maintenance	89
Dredging	82
Habitat Restoration/Improvement	61
Culvert	44
Boat Ramp Repair/Construction	32
Stormwater Drainage	32
Water Systems	32
Construction - Other	25
Fish Passage/Trapping	25
Flood Control	21
Pipeline Construction/Repair	21
Pilings	19
Dam Maintenance/Operation	18
Levee Maintenance	13
Vegetation Management	13
Drilling	11
National Fire Plan	17
Rip-rap	11
Water Diversion	11
Excavation/Mining	10
Watershed Activities	10
Channel Repair/Reconstruction	9
Gravel	9
Erosion Control	8
Fire Management	8
Timber Harvest/Sales	7
Fill	6
Harbor/Marina	6
Recreation	6
Riparian Work	6
Timber Sale	6
Seismic	6
Grazing	5
Research	5
Sewage/Wastewater	5

4.3.1 Hydropower dams

Hydropower activities represent a relatively small percentage of section 7 consultations regarding Pacific salmon and O. mykiss in the past. The consultations that have occurred, however, have at times been controversial and costly. A number of hydropower actions have been covered in Pacific salmon and O. mykiss consultations, including licensing/relicensing of projects; review of operations plans; construction of new projects; modifications to structures of dams (e.g., installation of fish passage facilities); changes in operations (e.g., change in flow regime); and removal of dams. The major Federal agencies responsible for hydropower activities in the area covered by the seven ESUs are the Federal Energy Regulatory Commission (FERC), U.S. Army Corps of Engineers (USACE), and the U.S. Bureau of Reclamation (USBR).

FERC issues licenses for privately owned hydropower projects. These licenses are valid for between 30 and 50 years depending on the extent of proposed new development or environmental mitigation and enhancement measures. The USACE and USBR also own and/or operate hydropower projects within the proposed critical habitat for Pacific salmon and O. mykiss. While there is no formal procedure for regular review of federally-operated projects, any change in operations or existing infrastructure may generate consultation regarding impact to the salmon/O. mykiss.

Multiple hydropower-related Federal and State regulations provide protection to the Pacific salmon and O. mykiss. Specifically, section 10(j) of the Federal Power Act (FPA) was promulgated to ensure that FERC considers both power and non-power resources during the licensing process.³³ Further, section 18 of the FPA states that FERC shall require the construction, operation, and maintenance by a licensee at its own expense of a fishway if prescribed by the Secretaries of Interior (delegated to the Service) and Commerce (NOAA Fisheries).

Through the consultation process, NOAA Fisheries may recommend reasonable and prudent alternatives (RPAs) regarding hydropower projects. These RPAs, which are assumed to be representative of the modifications needed to comply with section 7, may be broadly divided into three major categories: operational, capital, and programmatic. Operational changes are characterized as changes in hydropower production level or method, and may be engendered by modification to the flow regime.³⁴ Capital modifications involve direct investment in new or improved infrastructure, and require additional investment for regular operation and maintenance.³⁵

³³ Federal Power Act, 16 U.S.C. § 803(j) (1986).

³⁴ From a review of historical section 7 consultations regarding hydropower activities, operational changes include recommendations to: improve and manage flows through additional flow augmentation; reduce flow diversions; provide spill to increase fish passage efficiency; operate pools within a specified range; operate turbines within a specified range of efficiency; shut down turbines seasonally; draw down reservoirs; and implement restrictions on ramping rates.

³⁵ From a review of historical section 7 consultations regarding hydropower activities, capital modifications include: constructing and maintaining fish passage facilities (including ladders and screens where applicable); collection and transport of fish at particular sites; installing improved juvenile sampling facilities, surface bypass collectors, and/or spillway weirs.

Programmatic changes include all other types of modification including monitoring of fish passage efficiency and water quality, data collection and research, operation of fish hatcheries, predator control, habitat improvements or restoration, and purchase of land and water rights.³⁶

Individual hydropower dams vary substantially in their potential for harming Pacific salmon and O. mykiss, and so the type and extent of necessary modifications varies accordingly. Characteristics such as size and location, as well as the presence or absence of previous modifications, help determine the most likely range of modification. To reflect some of this variability, hydropower dams are divided into several categories, based on generating capacity and the nature of the impacts (modification v. removal). Modification costs are then estimated for each category.

Recommendations to augment flow or change the timing of flow through a project to facilitate fish passage can have significant economic impacts on a hydropower dam. Demand for power varies seasonally, thus the value of power changes throughout the year. To the extent that flow augmentation requires water to be passed at times of the year when it is less valuable, there may be an associated economic cost. Also, where fish passage through the dam is an issue, seasonal spill over of the dam may be required to reduce the risk of fatality associated with passage through the turbines. In this case, the spilled water no longer passes through the turbines and therefore cannot be used to generate electricity. The costs of more expensive electricity may be passed on to the power consumers in the form of rate changes.³⁷

The necessity, level, and method of flow regime changes accommodate the biological needs of Pacific salmon and O. mykiss at a particular project are determined on a case by case basis. Further, the economic impact associated with a flow regime change is dependent upon the type of project. For example, replacing power generated by peaking projects (i.e., projects that produce hydropower during periods of highest demand) is more expensive than replacing base power production. Until a hydropower project operation is reviewed, the type and level of flow changes necessary and feasible for species and habitat protection is speculative, and so the data needed to estimate these impacts are not available. ***Because of this, the economic impacts resulting from changes in flow regimes are not included in the cost ranges associated with each project.*** This likely leads to an understatement of total impacts associated with section 7 implementation for some or all of the ESUs.

³⁶ Programmatic changes from a review of a number of historical section 7 consultations include: implementing or improving capture and release programs (e.g., enlarging transport barge exits); monitoring, evaluation, and research programs; gas abatement programs; participation in research initiatives (e.g., investigating bypass improvement methods); managing riparian vegetation; controlling erosion and sediment; implementing timing constraints on in-stream construction; and increased pollution control standards.

³⁷ Lon Peters, Memorandum to Industrial Economics, Inc. "ESA Costs for the Hydropower Sector." November 18, 2003.

Three hydropower projects that are part of the Central Valley Project are a unique category and are not included in this analysis. This is due to significant uncertainties regarding recommendations to changes in operations, and the interrelatedness of the operations of the multiple projects that comprise the Central Valley Project.

The impacts of section 7 and critical habitat designation on hydropower flow regimes, while real and substantial, do not fit into the framework set by section 4(b)(2) of analyzing "the economic impact . . . of specifying any particular area as critical habitat." These impacts are considered in Appendix G in an analysis of the energy effects conducted to satisfy Executive Order 13211.

4.3.2 Non-hydropower dams and other water supply structures

Projects covered by this activity type include flood control activities, pumping plants, water diversions, water intake structures, and fish screen projects. Generally, Federal agencies, State agencies, regional public agencies, and regional private agencies supply water to end users by means of highly developed water systems consisting of dams and reservoirs, pumping plants, power plants and aqueducts. Agriculture relies on water diversion for irrigation of crops. Municipal suppliers provide water for both commercial and residential use.

Operation of the Federal water projects is subject to section 7 consultation under the ESA. Any water supplier providing water via contract with U.S. Bureau of Reclamation (USBR) or using infrastructure owned or maintained by the USBR is subject to section 7 consultation under ESA. Projects associated with privately owned diversions may require a Federal permit from USACE under sections 401 or 404 of the Clean Water Act.

The most common water supply activities resulting in section 7 consultations are related to construction or improvement of dams, diversions, and intakes. Infrastructure construction projects have been modified in their design, scope, maintenance requirements, and/or monitoring requirements in order to comply with section 7 for Pacific salmon and O. mykiss. NOAA Fisheries has also recommended adding additional components to a project. For example, to improve habitat in the area surrounding a project, the agency has required rock or woody debris be added to the site. NOAA Fisheries has requested monitoring devices be installed or additional data be collected by the Federal agency or permit applicant. Further, NOAA Fisheries has requested a suite of other minor facility operation and maintenance requirements.

While it is possible to estimate typical costs for modifications to infrastructure, design, and the other changes discussed above, it is more difficult to do so for constraints on the use of the water itself. While historical data exist to inform the value of foregone water or agricultural production, reliable data does not exist on water quantity changes attributable to section 7 consultation, now and in the future. Currently, there is no apparent consensus concerning how varying flow requirements will be implemented throughout the designation.³⁸

³⁸ Huppert et al. (2003).

In addition, as discussed in Section 2, it is very difficult to attribute the costs of impacts on water supply activities to the protection of a specific watershed. Flow changes at one point in a watershed often have biological effects that are felt downstream. If these effects extend beyond the border of the watershed, designation of the neighboring watershed or even others further downstream may trigger constraints on those activities. This means that the impact cannot be attributed to a single area's designation, but instead could come from the designation of any of a number of areas. Spreading costs equally throughout the water system is equally unsatisfactory, as the costs are triggered jointly, not accumulated as more watersheds are designated.

4.3.3 Federal lands management and grazing permits

A Federal nexus exists for all management activities occurring on Federal lands. This analysis groups the activities of the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) into one activity category because the two agencies have many similar land management goals and regulations, and because they frequently consult together. Activities conducted by the USFS and BLM are wide-ranging, but include fuel reduction activities, road construction, road obliteration, and road maintenance, maintenance of recreation facilities, fisheries programs, timber sales³⁹, permitting of livestock grazing⁴⁰, and permitting of various use permits. These activities are divided into two activity types: General land management activities (classified into 10 sub-activities) and permitting of livestock grazing.

The outcome of consultations with the U.S. Forest Service (USFS) or the Bureau of Land Management (BLM) on various land management activities is likely influenced by several important baseline regulations. In particular, the Northwest Forest Plan and PACFISH guidelines provide numerous baseline protections to Pacific salmon and O. mykiss.

As noted in the previous section, the Northwest Forest Plan defines Standards and Guidelines (S&Gs) for forest use throughout the 24 million acres of Federal lands in its planning area. Specifically, the NWFP provides S&Gs for management of timber, roads, grazing, recreation, minerals, fire/fuels management, fish and wildlife management, general land management, riparian area management, watershed and habitat restoration, and research activities on USFS and BLM lands. To accomplish its goals, the NWFP defines seven land allocation categories, including “matrix lands,” areas where the majority of timber is to be taken, and Riparian Reserves and Key Watersheds, where distances from rivers are set within which many activities are restricted.

³⁹ The consultation history indicates that NOAA consults on timber sales on Federal lands, but not on similar sales on private or other non-Federal lands.

⁴⁰ The consultation history indicates that NOAA consults on livestock grazing on Federal lands, but does not consult on similar activities on private or other non-Federal lands. The reason for this is that grazing on non-Federal lands rarely needs a Federal permit, and thus does not have a Federal nexus.

For Federal lands in Oregon, Washington, Idaho, and Northern California not covered by the NWFP, USFS and BLM adopted a management strategy specifically for anadromous fish protection.⁴¹ Like the NWFP, PACFISH provides guidelines for timber, roads, grazing, recreation, minerals, fire/fuels management, lands, riparian area, watershed and habitat restoration, and fisheries and wildlife restoration. Standards and guidelines under PACFISH are nearly identical to those in the NWFP.

4.3.4 Transportation projects

Transportation projects that affect Pacific salmon and *O. mykiss* habitat are wide ranging, but may include the widening of a road, the reconstruction of a bridge, or the restoration of a ferry terminal. These projects can produce environmental impacts that may directly kill or injure salmon, or may disturb habitat. The impacts can be direct (i.e., riparian destruction during a bridge replacement) or ancillary (i.e., storm water run-off disturbance following a road widening).

The Federal nexus for a transportation project may be through the permitting or funding provided by the Army Corps of Engineers (USACE), Federal Highways Administration (FHWA) and/or the Federal Aviation Administration (FAA). The USACE permits bridgework, roadwork, and railroad restoration projects that need Clean Water Act permits. FHWA funds bridgework, roadwork, railroad restoration projects, and ferry terminal maintenance, and the FAA permits aircraft/airport repair and maintenance. Roadwork, bridgework, and culvert projects encompass the majority of the transportation projects that have been consulted upon.

Examination of biological opinions, case studies, and other data indicate that NOAA Fisheries requires similar project modifications for road, bridge, and culvert projects. Project modifications typically required for transportation projects include pre-construction surveys; the development and implementation of a site-specific spill prevention, containment, and control plan (SPCCP) and removal of toxicants as they are released; water quality monitoring; use of boulders, rock, and woody materials from outside of the riparian area; monitoring and evaluation both during and following construction; and a variety of other measures.

4.3.5 Utility line projects

Activities classified as utility lines projects typically involve installation or repair of: pipes or pipelines utilized to transport gas or liquids; cables, lines, or wires used to transmit electricity or communication; and outfall structures such as of waste water treatment plants or powerplants. Associated activities that may impact the salmon include excavation, temporary sidelaying of excavated materials, backfilling of trenches, and restoration of the work site to pre-construction contours and vegetation.

⁴¹ This strategy was intended to be in place only for 18-months, beginning in February of 1995, but continues to be implemented.

Federal agencies that typically engage in consultation utility lines projects include USACE and FERC. USACE consults with NOAA regarding 404 Clean Water Act and/or Section 10 River and Harbors Act permits, while FERC consults on pipeline projects that have the potential to impact threatened and endangered species and their habitat.⁴² For projects that may impact wetlands or cross water bodies, FERC maintains a list of construction and mitigation procedures. These mitigation procedures include the use of directional drilling, rather than open cut construction, and suggest mitigation activities during the proposal stage.⁴³ A portion of the project modification costs estimated to be attributable to Pacific salmon and O. mykiss critical habitat may be overestimated as these measures may already be required.

4.3.6 In-stream activities, including dredging

In-stream activities that may impact Pacific salmon and O. mykiss include dredging, and construction or repair of breakwaters, piers, pilings, bulkheads, boat ramp, and docks. Although these projects are often undertaken by private or non-Federal parties, in most cases they must obtain a USACE permit. That USACE must then consult with NOAA Fisheries as required by section 7 of the ESA.

Turbidity associated with in-stream activities may interfere with the species' visual foraging, increase susceptibility for predation, and interfere with migratory behavior. Chemicals and waste materials including toxic organic and inorganic chemicals that accumulate in sediment may be directly harmful to aquatic life or a source of contamination through bioaccumulation in the food chain. The release of ammonia, a common by-product produced in anaerobic sediments, may affect aquatic species as it is re-suspended in the water column. In-stream activity impacts on invertebrate colonies may additionally result in some loss of salmonid prey. Finally, entrainment of Pacific salmon and O. mykiss can occur during dredging when the fish are unable to overcome the water velocities near the draghead and are pulled into the hold of the ship.

For projects that cover boat docks and ramps, bank stabilization projects, and breakwater and bulkhead projects, the modifications typically needed to comply with section 7 for the salmon and O. mykiss include shoreline planting, construction materials restrictions, use of bubble curtains, habitat improvement projects, development of a spill prevention contaminant control plan, implementation of stricter erosion controls, and project timing restrictions. For dredging, the modifications may include project timing constraints, additional survey work, and increased mobilization costs.

⁴² Personal communication with Robert Arvedlund, Federal Energy Regulatory Commission, February 25, 2003

⁴³ Federal Energy Regulation Commission. *Wetland and Waterbody Construction and Mitigation Procedures*. January 17, 2003.

4.3.7 National Pollutant Discharge Elimination System Permitted (NPDES) activities

The EPA and NOAA Fisheries recently authored guidance to States and tribes on the development of temperature criteria deemed protective of salmon and O. mykiss. As a result, facilities that require permits under NPDES must now ensure that effluent discharge does not raise the temperature in receiving waters above site-specific minimum temperature standards.⁴⁴ The two agencies have consulted under section 7 on various aspects of the EPA's approval of State Water Quality Standards. Activities for which NOAA has consulted with EPA in the past include development of Total Maximum Daily Loads (TMDLs), review of non-temperature related Water Quality Standards, clean up of Superfund sites, and review of pesticide applications.⁴⁵

The primary incremental standard motivated by concern for Pacific salmon and O. mykiss discussed in this report is temperature control. While NPDES-permitted facilities have always been required to adhere to certain temperature criteria associated with effluent discharge, the 2003 guidance has led to stricter standards where Pacific salmon and O. mykiss are known to spawn or rear. As a result, NPDES-permitted facilities in the Pacific Northwest are required to ensure that their effluent discharge does not raise the temperature in receiving waters above site-specific minimum temperature standards.⁴⁶ To comply with the salmon temperature criteria, NPDES-permitted facilities identify and employ a host of temperature control procedures through Temperature Management Plans (TMPs). Controls include process optimization, pollution prevention, land application, and cooling towers.

4.3.8 Sand and gravel mining

Mining activities that affect Pacific salmon and O. mykiss generally include the removal of sand and gravel from active river channels and floodplains for industrial purposes, such as for road construction material, concrete aggregate, fill, and landscaping.⁴⁷ Gravel mining is an activity permitted by USACE under sections 401 and 404 of the Clean Water Act, or under section 10 of the Rivers and Harbors Act of 1899.

There are three basic types of gravel mining in salmon habitat: dry-pit mining, wet-pit mining, and bar skimming or scalping. Wet-pit mining involves the use of a dragline or hydraulic excavator to remove gravel from below the water table and can directly destroy spawning habitat, increase

⁴⁴ U. S. Environmental Protection Agency, EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards, EPA 910-B-03-002, April 2003.

⁴⁵ As a result of Washington Toxics Coalition, et al., v. EPA, C01-0132 (W.D. WA), the EPA may have to consult more actively with NOAA Fisheries on pesticide applications. More information on the impact of the resulting constraints on pesticide use are included in Appendix H of this report.

⁴⁶ U.S. Environmental Protection Agency. 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA 910-B-03-002. Region 10 Office of Water, Seattle, WA.

⁴⁷ "NOAA Fisheries National Gravel Extraction Policy," National Marine Fisheries Service, 2002.

turbidity, increase suspended sediment, and increase gravel siltation in salmon habitat areas. Gravel bar skimming typically occurs above the water table, but may also impact aquatic habitat by destabilizing the banks and increasing suspended sediment.⁴⁸ Dry-pit mining occurs outside the active stream channel, and typically is considered by NOAA Fisheries to have fewer direct effects on salmon, though degrading the morphology of the channel is still a concern.⁴⁹

NOAA Fisheries states that gravel mining may result in impacts such as: loss or degradation of spawning beds a juvenile rearing habitat; migration blockages; channel widening, shallowing, and ponding; loss of hydrologic and channel stability; loss of pool/riffle structure; increased turbidity and sediment transport; increased bank erosion and/or stream bed downcutting; and loss or degradation of riparian habitat.⁵⁰

4.3.9 Residential and commercial development

The potential for adverse economic impacts arising from constrained residential and related development is a frequent concern to communities in which critical habitat has been proposed for designation. The nature and magnitude of any economic impact attributable to critical habitat designation will depend upon baseline land and housing market conditions and the extent to which a designation distorts these initial conditions. A common concern is that the designation of critical habitat may reduce the overall amount of land available to the market, and increase the price of developed land and housing.

If critical habitat designation inhibits the development potential of some parcels, the supply of land available for development will be reduced. In areas that are already highly developed, or where developable land is scarce for other reasons (i.e., non-critical habitat-related regulations), this reduction in available land and the corresponding increase in price could be significant, and ultimately translate into fewer housing units being built within the affected market, affecting both producers and consumers. In areas where developable land is relatively plentiful, however, developers and builders will be able to identify substitute sites for projects, thereby limiting economic impacts to the owners of specific parcels that suffer a diminishment in their land's value.

In addition to the primary economic impacts identified above, individuals may have other types of economic and financial concerns in residential and commercial development markets, generally

⁴⁸ "NOAA Fisheries National Gravel Extraction Policy," National Marine Fisheries Service, 2002. NOAA Fisheries is in the process of revising this guidance.

⁴⁹ Email communication with Erin Strange, NOAA Fisheries, Sacramento Office, December 9, 2003.

⁵⁰ "NOAA Fisheries National Gravel Extraction Policy," National Marine Fisheries Service, 2002.

falling into the category of regional economic impacts.⁵¹ Regional economic impacts reflect changes in *local* output, employment and taxes. The principal category of regional impacts associated with critical habitat designation in areas of residential development is potential changes in revenues and employment in construction-related firms and other industries that support builders and developers. Specifically, there may be a concern that if development activity decreases in a given area, these industries may experience economic consequences.

A second category of regional impacts is the potential for forgone tax revenues associated with reduced residential development. That is, reduced development potential in an area may lead to lower real estate and other tax revenues.⁵² It is important to note, however, the *net* impact of any expected changes in tax revenues in affected communities. Changes in revenues may be offset by an changes in municipal expense; thus, it is important that any estimated impacts in this category are net of these service expenditures.

Finally, in more extreme cases, the impact of critical habitat designation on regional economies may be a concern. Specifically, speculation surrounds whether designation will delay and/or impair an area's ability to realize economic growth by influencing development patterns. With the exception of cases in which critical habitat designation precludes a large proportion of available land from development, however, designation is unlikely to substantially affect the course of regional economic development.⁵³

Concern may exist that critical habitat designation will depress private property values below the levels associated with anticipated project modifications described above. That is, that all else being equal, a property that is designated as critical habitat will be stigmatized and have a lower market value than an identical property that is not within the boundaries of critical habitat. Public attitudes about the limits and costs that critical habitat may impose can cause real economic effects to the owners of property, regardless of whether such limits are actually imposed.

The designation of critical habitat for the Pacific salmon and O. mykiss ESUs under consideration is unlikely to increase costs to developers, reduce revenues, impose mitigation costs, or result in project delays, at least in significant amounts. There are two reasons significant impacts are not anticipated. First, the connection to section 7 consultation regarding the ESUs are limited to specific

⁵¹ Elliott D. Pollack and Company, The Economic and Fiscal Impact of the Designation of 60,060 Acres of Privately Owned Land in Pima County, Arizona as Critical Habitat for the Cactus Ferruginous Pygmy-Owl, prepared for Southern Arizona Homebuilders Association, February 25, 1999.

⁵² Ibid.

⁵³ Meyer, Stephen M. 1998. "The Economic Impact of the Endangered Species Act on the Housing and Real Estate Markets." New York University Environmental Law Journal. 6(450):1-13.

components of a development, and are expected to have no direct impact on the supply of land or housing. Second, project modification costs are expected to be modest (anticipated to range from \$230,000 to \$240,000) and consultations regarding development projects are rare.⁵⁴

This assessment is supported by the consultation history. Consultations on development projects have not included evaluation of an entire development project. Past consultations have instead addressed the specific activities with a Federal nexus that have the potential to affect Pacific salmon and O. mykiss, such as stormwater outfall structures. Project modifications have included timing restrictions for in-stream work, vegetation replacement, filtration systems, and water quality monitoring.

For this reason, the available data also do not suggest significant stigma effects will result associated with the designation of critical habitat. Section 7 does not have strong historical connection to restrictions on private property, and this is not expected to change in the future. If such stigmatization does occur, it seems likely that experience with the actual strictures of critical habitat designation will remove any premium that might be characterized as a stigma effect.

4.4 The Costs of Section 7 Impacts

Enforcing section 7 for these types of activities may result in two type of impacts. First, the consultation process itself imposes costs both on NOAA Fisheries and on the Federal agency or other party (or both) responsible for the activity. As explained below, our framework's focus on individual projects does not support an accurate estimate of these costs. Nevertheless, they are discussed on a general level. Second, modifying a project to bring it into compliance with section 7 may be costly. These costs may occur following consultation, if the party responsible for the activity adopts whatever measures NOAA Fisheries specifies, or they may occur prior to consultation, if the responsible party modifies the activity (either routinely or on a case-by-case basis) in anticipation of the consultation. This analysis accounts for both cases by assuming that a project located in a critical habitat area will bear these costs, without specifying how that will come about.

Because the necessary data are not available, particularly at the geographic scale of the proposed designations, this analysis does not consider two other possible avenues for impacts to occur. It assumes that activities located in critical habitat will incur the modification costs identified (according to the estimated probabilities). Alternatively, the project could be moved (if possible) to a location that does not affect Pacific salmon and steelhead, or the project could be cancelled. A basic assumption underlying any economic analysis, including this one, is that economic actors choose the least costly avenue for their actions. If relocation or cancellation is less costly

⁵⁴ Personal communication with DeeAnn Kirkpatrick, NOAA Puget Sound Habitat Conservation Division, Fishery Biologist Southern Puget Sound Region, October 31, 2003. Personal communication with Eric Shott, NOAA Fisheries Santa Rosa Field Office Section 7 Coordinator, November 5, 2003. Personal communication with Gary Stern, NOAA Fisheries Santa Rosa Field Office, San Francisco Bay Team Leader, November 5, 2003.

(accounting for potentially fewer project benefits as well), one of those alternatives would likely be chosen. Therefore, our assumption that projects will not be relocated or cancelled means that , our approach therefore may overstate the cost of section 7 impacts.

4.4.1 Consultation costs

A routine feature of economic analyses of critical habitat designation is an accounting of the costs of the consultation themselves. The geographic scope of the Pacific salmon and steelhead designations and the nature of the available data preclude an area-by-area accounting of these costs. Instead, these costs are discussed generally but specific costs are not attributed to particular areas.

The data utilized in this analysis account for the volume of projects that may be modified subsequent to or in anticipation of a section 7 consultation. While the cost of a consultation is a real impact of section 7, it is not easily allocated to a specific area given our methods for assessing project volumes for the following reasons.

First, a single consultation can cover more than one project. While the majority of consultations cover a single project, the exceptions are important. For example, programmatic consultations determine how a type or types of project, not the projects themselves, can be modified to ensure they comply with section 7. As a result, these consultation can cover large numbers of projects.

While programmatic consultations are likely to be more costly, applying a per-project formula would significantly inflate the estimated level of consultation cost. Moreover, when multi-project consultation occur, they are likely to cover a wide geography. This makes it difficult to attribute those consultation costs to a particular area such as a single watershed.

A second difficulty stems from the method used in this analysis to measure the volume of Federal lands management activities, a significant source of cost impacts. Based on an analysis of programmatic consultations, this analysis uses a per-acre cost estimate, rather than a per-project estimate. Because of this, there is no way to gauge the number of consultations associated with a level of activity in a particular area. In any case, given that many of these activities are in fact covered by programmatic consultations, using the number of projects to estimate consultation costs would be inaccurate. For both of these reasons, consultation costs are not estimated for each particular area.

This does not mean these costs are insignificant. As shown above in Table 4-3, Pacific salmon and steelhead have been the subject of approximately 1,098 consultations during 2000-2003. The consultation database classifies the consultations in the following categories: 114 formal consultations, 707 informal consultations, 172 technical assistances, and 105 consultations of unspecified type. The FWS has estimated costs associated with their consultations, and while there is no assurance that NOAA Fisheries costs are similar, using the FWS estimates can still give some indication of the potential magnitude of these costs. The FWS estimates that a formal consultation costs the Federal government between \$10,000 and \$40,000, while an informal consultation costs

about \$1,100.⁵⁵ Using the high end of the formal consultation range for programmatic consultations, and the informal consultation estimate for other types of consultations, gives the following cost estimates for Pacific salmon and steelhead consultations during 2000-2003:

- Formal: \$1.14 million to \$4.56 million
- Informal: \$778,000
- Technical Assistance: \$189,000
- Other types: \$116,000
- Total cost: \$2.22 million to \$5.64 million

Without data on NOAA Fisheries own per-consultation costs, it is difficult to gauge the reasonableness of these estimates. In any case, as noted above, it may be difficult to attribute this type of cost to a particular area.

4.4.2 Per-project costs and the occurrence of impacts

For each type of activity, this analysis developed estimates of the costs for modifying a project to comply with section 7, and of the volume of the activity in each watershed. These two estimates are the basic elements of the approach used in the analysis. Our method for making these estimates took the following steps:

1) *Estimate the cost of project modifications.* For most activity types, modification costs are borne in one year and so no discounting is needed (for this step). For others, expenditures on modifications are likely to take place over a number of years. In these cases, the stream of expenditures is discounted using both a three percent and seven percent discount rate. (For the purposes of the discussion in this report, sometimes only the results for the seven percent discount rate are presented.⁵⁶ The summary tables and the full set of results in the appendices report the results for both discount rates.)

2) *Determine a forecast period.* Traditionally, an economic analysis uses a single time frame over which all impacts and costs are estimated. The data sources used, however, vary widely in the length of time covered. For that reason, this analysis uses different time periods over which to forecast an

⁵⁵ Draft Economic Analysis of Critical Habitat Designation for the Bull Trout, Division of Economics, U.S. Fish and Wildlife Service, March 18, 2004.

⁵⁶ In many instances, changing the discount rate does not change the cost estimate because this analysis uses annualized costs, where the cost stream is uniform. The uniformity comes from the assumption that, for most activities, modification expenditures are borne in one year but the exact date is uncertain and assumed to be distributed uniformly over the forecast period. Under these assumptions, the annual expected value (that is, the one-year modification expenditure multiplied by the probability of the modification occurring in that year) is constant, and is therefore equal to the annualized expected cost regardless of the discount rate.

activity type's occurrence. In some cases, a period of one year is used, as estimates are available of the annual volume of an activity. In other cases, the period is longer, sometimes set by the periodicity of permits or other considerations.

3) *Estimate the probability that a project will be modified in a particular year during the forecast period.* This analysis assumes that not all projects will require immediate modification to comply with section 7. In some cases, it assumes those modifications are certain to take place in a particular year (e.g., the year of a FERC license renewal). In other cases, the consultation record is used to estimate a probability distribution over the forecast period. In still others, where no information on the probability distribution is available, this analysis assumes it is uniformly distributed through the forecast period.

4) *Calculate the annual expected cost of project modifications.* The cost estimate obtained in the first step is the certain cost of modifying the project. In third step, however, the uncertainty regarding the need to modify is recognized, and so this last step incorporates the probabilities estimated in that step. This analysis first calculates the expected cost of modifications for a particular year (the probability that the modification will take place in a given year multiplied by the cost of modification) for each year in the forecast period. Each year's expected cost (again, three percent and seven percent discount rates are both used) is then discounted and the sum is taken to obtain the present value of the expected modification costs. Because the forecast period varies across activity types, however, using the present value will give relatively high costs for those activities with longer forecast periods. For that reason, this present value is annualized to obtain an annual expected modification cost.⁵⁷

In almost all cases, a range of possible modification costs is presented. Because our data sources for the cost estimates do not constitute a random sample, an average over the range of estimated costs can not be used as the "representative" estimate. This analysis therefore assumes that the endpoints of the range represent the minimum and maximum values of a symmetric cost distribution, and uses the midpoint of the range as the representative cost estimate.

The remainder of this section summarizes the methods for deriving cost estimates for each activity's potential modifications, as well the estimates and their ranges (assuming a seven percent discount rate). Following that, this section describes how the spatial and temporal occurrence of the activity was estimated. Finally, for each activity, potential limitations of the analytical methods are presented. The discussion below is summarized in Table 4-3, and a more detailed presentation is given in Appendix D.

⁵⁷ Incorporating uncertainty over time in this way means that the actual modification costs for a specific activity may be very different on a year-to-year basis than our estimate. Taking the expected cost over time produces an estimate of the *average* cost over the forecast period. The actual level of costs, however, may be zero for all years but one, and very high in the one other year. Because the one year of the actual costs is uncertain, expressing costs as an expectation enables us to compare levels of costs across activities with different probability distributions.

4.4.2.1 Hydropower projects

Cost Estimates

For hydropower dams, the magnitude of potential modification costs varies widely across dams. To account for some of this variation, this activity type is divided into several categories. Data regarding California hydropower projects was less comprehensive than the available Northwest region hydropower data, for example regarding the status of fish passage and amount of installed capacity. Because of this, the likelihood of a hydropower project possessing particular traits is often extrapolated from the available data regarding hydropower projects in the Northwest as described below.

- Small: Projects with installed capacity of less than 5 MW: \$2.1 million (\$24,000 - \$4.2 million). According to FERC guidelines, hydroelectric projects with an installed capacity of less than five megawatts (MW) may be exempted from the licensing process. Because these projects are not currently generating power, or are generating power in small amounts, estimated costs are based on the project modification costs of non-hydropower dams, which are anticipated to range between from \$24,000 to approximately \$4.2 million.

- Medium: Projects with installed capacity ranging from 5 to 20 MW: \$5.8 million (\$0 to \$11.5 million). The high-end of this estimate comprises: 1) Capital costs, such as facilities improvements, of \$8 million, from a survey of 17 hydropower projects in the Northwest United States; 2) Species surveys at \$2,600 per year for ten years (BPA 1992), 3) Research on species survival and passage efficiency at \$150,000 per year for ten years (Huppert et al 1996); and 4) Water quality monitoring at \$200,000 per year for ten years (Huppert et. al., 1996). These costs represent the suite of project modifications most likely to be recommended at medium-sized hydropower projects.

- Large:

- a. Projects with installed capacity of greater than 20 MW that already have, or will not require, fish passage facilities: \$45.2 million (\$11.5 million to \$79.1 million)-Northwest Region Only. The Pacific Northwest Hydrosite Database (PNHD) used for the economic analysis of hydropower projects for the Northwest Region includes information on the status of fish passage facilities at each project, specifying that facilities are present, not required, not present, or unknown. Where passage facilities were determined to be present or not required, the average costs of related operations and maintenance of these facilities was removed from the high-end estimate in the cost range (i.e., high-end estimate of \$136 million less approximately \$57 million over ten years for fish passage-related costs).

- b. Projects with installed capacity of greater than 20 MW that do not have, but may require, fish passage facilities: \$73.9 million (\$11.5 million to \$136 million)-Northwest Region Only. The high-end of the cost range is the high-end cost for project modifications to a hydropower project from a survey of utility companies and Public Utility Districts in the Pacific Northwest. The estimate includes annual costs of fish-related operations (hatchery and spawning operations, predator control studies, fish ladders and operations, fish survival studies, etc.), fish-related maintenance (fish ladder and bypass maintenance), and associated debt services (surface collector, diversion screens juvenile fish bypass system, etc.) projected over ten years.
- c. Projects with installed capacities of greater than 20 MW where the status of fish passage is currently unknown: \$56.4 million (\$11.5 million to \$101.3 million). In the absence of information regarding the presence of fish passage (as is common for the California hydro projects), this estimate reflects the probability of the presence of fish passage based on data from the Northwest Region. In the Northwest, approximately 61 percent of projects with installed capacities greater than 20 MW currently have or do not require fish passage facilities, and 39 percent either do not have facilities or the status is unknown. This cost estimate therefore reflects at 61 percent chance of the project modifications resulting in costs of \$45.2 million and a 39 percent change of modifications resulting in costs of \$73.9 million as described above. The cost estimates for the high and low end of the range of costs is likewise calculated.

- Projects with unknown installed capacity: \$7,530,000 (\$1.4 million to \$13.6 million). Where installed capacity is unknown, the cost estimate reflects the likelihood of the project having various levels of installed capacity based on the available data regarding hydropower projects in the Northwest. In the Northwest region, 81.2 percent of dams have installed capacity of less than five MW, 6.4 percent have installed capacity between five and 20 MW, and 12.4 percent have an installed capacity of greater than 20 MW.

Spatial Distribution

- This analysis applies latitude/longitude data from the USACE National Inventory of Dams and the California Department of Water Resources, Bulletin 17 for all hydroelectric projects in the SWR to project spatial occurrence.⁵⁸

⁵⁸ California Department of Water Resources, Division of Safety of Dams. Dams within the Jurisdiction of the State of California, Bulletin 17.

Temporal Distribution

- For Federal Energy Regulatory Commission (FERC) licensed dams, section 7 consultation and subsequent project modification is anticipated to begin concurrent with the expiration of the current FERC license.
- Federal dams are not subject to FERC relicensing and, as such, operations may not be reviewed on a standard schedule. Some Federal hydroelectric projects undergo an operations review approximately every ten years. This analysis assumes that consultation for Federal dams will occur sometime within the next ten years for each Federal hydropower project. An equal probability is assigned to this consultation beginning in each year over the next ten years (i.e, a consultation has a ten percent probability of occurring in any given year).
- Dams with installed capacity less than 5 MW are assumed to have a ten percent probability of incurring modification costs during the next twenty years, with the probability distributed uniformly over the period.
- Where the licensing information is not available, this analysis assumes that consultation will occur sometime over the next 30 years, due to the fact that FERC licenses typically last 30 to 50 years. This analysis assigns an equal probability to this consultation beginning in each year over the next 30 years.
- Costs of project modifications to hydropower projects are assumed to be incurred uniformly over a ten year time period beginning in the year of potential section 7 consultation.

Caveats

- Spatial data for hydropower projects may vary according to data source. This is due to the fact that data sources may map the location of any number of components of the project, including dam infrastructure, turbine, powerhouse, afterbay, or forebay. To the extent possible, this analysis uses the location of dam infrastructure for the spatial analysis. No single, comprehensive dam location and attribute data layer exists, however. Certain instances have been identified where dam locations vary across different data sources. The location of every dam in the data layers has not been independently corroborated.
- No comprehensive forecast for consultations at hydropower dams exists. To estimate the expected start date for future consultation, this analysis employs a combination of methods based upon FERC relicensing schedules, operating review schedules for certain Federal dams, and a 30 year uniform probabilistic distribution of consultation for the remaining dams. In addition, it is assumed that once consultation and modifications commence, related expenditures will occur uniformly over a ten year time frame following consultation. In reality, start dates, duration, and distribution of consultations and modifications across all dams may vary from these assumptions.

- Hydropower projects may be required to provide additional flow for Pacific salmon and O. mykiss, and as a result may experience significant economic impacts to the extent that increased flow results in decreased or redistribution of power generation. Specific dam projects that will be required to provide this flow, and how (e.g., spill) the flow augmentation may be achieved, are difficult to predict. The likelihood of a particular project being required to provide flow for salmon will depend on many factors, including biological significance of the dam project to Pacific salmon and O. mykiss survival and recovery, the seasonality of flow, the economic importance of the dam project, whether there is public concern over the project, and other factors. ***As a result, costs associated with flow requirements are not included in estimates of modification costs for hydropower projects.***

4.4.2.2 Non-Hydropower Dams and Water Supply Structures

Cost estimates

- Infrastructure costs: \$2.1 million (\$24 thousand to \$4.2 million).

For dams other than hydropower projects, infrastructure costs to accommodate salmon needs were estimated from several case studies of municipal water intake projects (estimated to range from \$24,000 to \$670,000). Using PNHD data, costs to install fish passage and fish screens were estimated to range from \$92,000 to \$4.2 million. Because dam projects may bear any combination of the costs estimated, costs are estimated to range from \$24,000 to \$4.2 million for dams that are required by section 7 consultation to accommodate Pacific salmon and O. mykiss needs. The current analysis assumes that all federally regulated non-hydropower dams and dams with large reservoirs (defined as dams in the 90th percentile or higher of reservoir storage capacity) are certain to bear costs associated with salmon needs at some point over the next 20 years. This time frame reflects the past rate of formal consultation on non-hydropower related projects in our consultation record (approximately 10 per year). Other non-hydropower dams are assumed to have a ten percent probability of consultation and modification during this period.

- Operation of Water Projects (e.g., flow regime, withdrawal constraints): Not quantified.

Costs to provide additional water flow for salmon are difficult to estimate because reliable data on water quantity changes attributable to section 7 consultation, now and in the future, do not exist. There also does not appear to be a consensus of how varying flow requirements will be implemented throughout the designation. Further, attributing costs to provide flow to a specific watershed is difficult because water supply constraints in one watershed often have effects that are realized throughout the water system. ***As a result, costs associated with providing additional flow for Pacific salmon and O. mykiss are not included in this analysis.***

Spatial Distribution

- This analysis applies latitude/longitude data for dams other than hydroelectric projects from the USACE National Inventory of Dams to project the spatial occurrence of this activity type, covering 648 dams in the California..

Temporal Distribution

- Limited data exist regarding maintenance schedules for non-hydropower projects. This analysis assumes that a consultation, if it occurs, will occur sometime over the next 20 years, based on the historic frequency of consultation of these project types.
- This analysis assumes that federally regulated dams and dams with large reservoirs are certain to face consultation and modification during a twenty year period, with the probability distributed uniformly across this period. Other non-hydropower project dams are assigned a probability of incurring costs related to Pacific salmon and O. mykiss of ten percent.

Caveats

- Spatial data for dam projects other than hydropower projects may vary according to data source. This is due to the fact that data sources may map the location of any number of components of the project, including dam infrastructure, as separate features. To the extent possible, this analysis uses the location of dam infrastructure for the spatial analysis. Certain instances have been identified where dam locations vary across different data sources. The location of every dam in the data layers has not been independently corroborated.
- No comprehensive forecast for consultations at non-hydropower dams exists. Consultations at particular non-hydropower projects are assumed to occur with uniform probability over the next 20 years.
- While dam projects may be required to provide additional flow for salmon may experience significant impacts, the specific dam projects that will be required to provide this flow are difficult to predict. The likelihood of a particular project being required to provide flow for salmon will depend on many factors, including biological significance of the dam project to salmon survival and recovery, the seasonality of flow, the economic importance of the dam project, whether there is public concern over the project, and other factors.

4.4.2.3 Federal Land Management Activities (excluding grazing)

Cost estimates

- Land management activities (excluding grazing): \$4.91 to \$18.27 per acre per year, depending on region.

Programmatic activities of the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) are grouped into one category because they have similar land management goals and regulations, and because they frequently consult together. Locations of future USFS projects are projected using data from quarterly Statement of Proposed Actions (SOPAs) released by national forests. Within each of two regions (Northern and Southern California), SOPA projects are grouped into ten activity categories. To create an estimated frequency of these activities, a regional average number of

activities from SOPAs was estimated on an annual basis. Projects occurring on BLM lands are assumed to occur with the same relative frequency as those occurring on national forest lands within the same region.

- For each category of activity, past section 7 consultation project modifications were documented and costs were estimated. Per-acre estimates of project modification costs were developed using the average annual number of projects for each forest divided by forest acreage. These estimates were then averaged across each region. Nominal annual cost estimates for each region are for Northern California \$8.95 (\$4.91 to \$12.98) per acre, and for Southern California \$12.16 (\$6.04 to \$18.27) per acre.

- Costs of project modifications to programmatic Federal land management projects are incurred in one year.

Spatial Distribution

- This analysis identifies acres of land within BLM Districts and National Forests per watershed within each of the two regions using GIS land ownership data. Data from representative SOPAs are averaged to provide an estimate of the types of projects that may occur on these Federal lands. The number of activities projected to occur in the proposed critical habitat is then based on the acreage of Federal lands in each watershed.

Temporal Distribution

- On average, the number of projects listed in each SOPA generally represents the number of projects that will occur on a National Forest in a given year.

- Projects occurring on BLM lands are assumed to occur with the same relative frequency as those occurring on USFS lands within the same region.

Caveats

- This analysis assumes that the SOPA lists all proposed and ongoing activities occurring within each national forest, and that these activities tend to occur with seasonal regularity.

- This analysis assumes that the amount of Federal lands activity within each watershed is related to the amount of Federal land within that watershed.

- This analysis identifies acres of land within BLM Districts and National Forests per watershed within each of the two regions. This analysis is subject to the limitations of the GIS data used for the calculations.

4.4.2.4 Livestock Grazing on Federal Land

Cost estimate

- Livestock Grazing: \$29.00 per acre per year (\$11.00 to \$48.00).

Grazing on Federal lands requires a permit from the land management agency. Direct costs of compliance with section 7 are estimated by grazing allotment on a per-acre basis. These costs are then distributed according to the amount of Federal grazing lands in each watershed. This analysis assumes the modification costs are borne in one year.

Spatial Distribution

- Federal grazing lands were identified by intersecting spatial coverages for statewide grazing allotments with a USFS/BLM ownership coverage in the study area.

Temporal Distribution

- This analysis assumes that each acre of Federal lands grazing will bear modification costs for section 7 consultations related to Pacific salmon or O. mykiss at some point over the next ten years, when the permit is renewed. This analysis assumes an equal probability of the consultation in a given year within the ten year period.

Caveats

- Each acre of grazing land within critical habitat areas is assumed to be subject to section 7 implementation. In fact, many projects may not affect salmon and O. mykiss habitat.

4.4.2.5 Transportation projects

Cost estimates

- Bridge and Culvert Projects: \$40,000 - \$103,000 per project (range depends on project mileage). Transportation projects are typically required to have a consultation when they involve permitting or funding by the Army Corps of Engineers (USACE), Federal Highways Administration (FHWA) and/or the Federal Aviation Administration (FAA). Per-project estimates of the direct costs of compliance with section 7 were developed using cost per project miles for variable costs combined with per project fixed costs. Project modifications included in the cost estimates include bank stabilization, monitoring and evaluation, habitat improvement, spill prevention contaminant control plan, erosion control, and timing restrictions.

- Road Projects: \$34,900 - \$95,000 per project (range depends on project mileage). Transportation projects are typically required to have a consultation when they involve permitting or funding by the Army Corps of Engineers (USACE), Federal Highways Administration (FHWA)

and/or the Federal Aviation Administration (FAA). Per project estimates of the direct costs of compliance with section 7 are developed using cost per project miles for variable costs combined with per project fixed costs. Project modification costs include bank stabilization, monitoring and evaluation, habitat improvement, spill prevention contaminant control plan, erosion control, and timing restrictions, etc.

- Costs of project modifications to transportation projects are assumed to be borne in one year.

Spatial Distribution

- The location of transportation projects is based on spatial data from transportation plans for California, specifically the California Transportation Investment System (CTIS), that identifies locations of historic and future projects.

Temporal Distribution

- Although the transportation plans vary in scope (three to six years), it is assumed that the point locations of these projects represent “typical” locations of transportation projects initiated and completed over a five year time horizon.

Caveats

- According to the transportation plans, the vast majority of projects are forecast to occur within a five-year time frame. This analysis therefore employs a forecast period of five years for transportation projects and assumes that all scheduled projects will occur within this forecast period. In reality, a number of projects are scheduled to occur beyond the forecast period. In these instances, this analysis overstates the costs of these projects.

- Spatial data identifies the location of specific transportation projects expected to occur over a given time period. Because the time frame of transportation plans do not match the 2003 to 2008 forecast period for the analysis, the actual locations of future projects may differ slightly from those listed in the transportation plans, but are expected to occur in similar geographic areas (e.g., urban centers).

4.4.2.6 Utility Line Projects

Cost estimates

- Outfall Structure and Pipelines: \$101,000 (\$100,000 to \$102,000). Utility line projects typically result in consultation with USACE for permitting of outfall structure and pipelines. The cost estimate represents a range of costs for standard modifications to utility projects including, implementing erosion control measures, directional drilling, restoration of construction sites, and timing restrictions.

Spatial Distribution

- The location of utility projects is based on the latitude and longitude of historic USACE permits for utility line and outfall structure projects. Permit data were collected from the Los Angeles, Sacramento, and San Francisco USACE Districts. The data include locations of permits from approximately 1996 to 2003, and vary by district.

Temporal Distribution

- This analysis assumes that consultation related to projected permit applications is certain to occur sometime within the next eight years. An equal probability is assigned to these consultations beginning in each year over the next eight years.

Caveats

- Historic location of USACE permits for utilities is the most reasonable predictors of future locations available.

4.4.2.7 In-stream activities (excluding dredging)

Cost estimates

- Boat Dock, Boat Launch, Bank Stabilization: \$54,500 (\$25,000 to \$84,000).

Boat dock, boat launch, and bank stabilization projects are typically required to have a consultation through a connection with USACE permits. This estimate represents the midpoint of a range of costs for modifications typically found in consultations. These costs include shoreline planting, construction materials restrictions, use of bubble curtains, habitat improvement, spill prevention contaminant control plan, erosion control, and timing restrictions, and so forth.

Spatial Distribution

- The location of in-stream projects is based on the latitude and longitude of historic USACE permits excluding 1) activities likely to be captured elsewhere in the analysis (e.g., roads, bridges, dredging), and 2) activities not included in the analysis (e.g., restoration). Permit data were collected from the Los Angeles, San Francisco, and Sacramento USACE Districts. The data include permits from 1996 to 2003, and vary by district.

Temporal Distribution

- This analysis assumes that consultation related to projected permit applications is certain to occur sometime within the next eight years. An equal probability is assigned to this consultation beginning in each year over the next eight years.

Caveats

- Historic location of USACE permits for utilities is the most reasonable predictors of future locations available.

4.4.2.8 Dredging projects

Cost estimates

- Dredging: \$821,000 (\$332,000 to \$1,300,000).

Dredging projects are typically required to have a consultation through a connection with USACE permits. This estimate represents the midpoint of a range of costs for modifications typically found in consultations. These costs include work window constraints, extension of the prescribed work window, additional survey work, and mobilization costs.

- Dredging of San Francisco Bay: \$651,000 (\$162,000 to \$1,140,000).

In the San Francisco Bay, dredging is regulated by a Long-Term Management Strategy (LTMS) For the Placement of Dredged Material in the San Francisco Bay Region. The LTMS gives dredging windows, disposal sites, and targets for distribution of dumping among sites. NOAA treats these permit applications programmatically unless projects cannot occur within the dredging windows and a formal consultation is required. Based on historical project experience, this is expected to occur 14 percent of the time. As work windows and disposal sites are required by the LTMS, these potential project modifications are considered baseline. Therefore, mobilization costs are the only costs attributable to the designation of critical habitat, these costs are anticipated to be incurred 14 percent of the time, and include dredging windows, disposal sites, and targets for distribution of dumping among sites.

Spatial Distribution

- The location of dredging projects is based on the latitude and longitude of historic USACE dredging permits. Permit data were collected from the San Francisco, Los Angeles, and Sacramento USACE Districts. The data include permits from 1996 to 2003, and vary by district.

Temporal Distribution

- For the purposes of this analysis, it is assumed that consultation related to projected permit applications is certain to occur sometime within the next eight years. An equal probability is assigned to consultation beginning in each year over the next eight years.

Caveats

- Historic location of USACE permits for utilities is the most reasonable predictors of future locations available.

4.4.2.9 NPDES-permitted Activities

Cost estimates

- Temperature Management Plan Compliance activities for Major Projects: \$816,000 (\$582,000 to \$1,110,200).

National Pollutant Discharge Elimination System (NPDES) permitted facilities are required to ensure effluent discharge does not raise the temperature in receiving waters above site-specific minimum temperature standards. The section 7 consultation record indicates salmon concerns have produced more restrictive measures for temperature controls. The high end of the range includes annual operation and maintenance costs of up to \$685,200 and total capital costs of \$425,000 over 20 years. This range in costs represent direct compliance costs for “major” NPDES facilities, defined as those facilities discharging greater than one million gallons per day based on an EPA economic assessment of four major NPDES-permitted facilities in Oregon.⁵⁹

- Temperature Management Plan Compliance activities for Minor Projects: \$136,000 (\$0 - \$272,000). The high end of the range includes annual operation and maintenance costs of up to \$6,800. The range in costs represent direct compliance costs for “minor” NPDES facilities, defined as those facilities discharging less than one million gallons per day based on an EPA economic assessment of a sample of five minor NPDES-permitted facilities in Oregon.

Spatial Distribution

- The location of future consultation regarding compliance with temperature water quality criteria is based on the latitude and longitude of major and minor National Pollutant Discharge Elimination System (NPDES) permitted facilities within the proposed critical habitat. This analysis assumes facilities will undertake various measures to ensure the temperature of surrounding waterways do not exceed regulatory standards developed specifically to protect Pacific salmon and O. mykiss.

- Permit data were collected from the Washington Department of Ecology, Oregon Department of Environmental Quality, EPA Region 10, and EPA Region 9 and represent the location of facilities as of 2003 or 2004.

- Based on the historical section 7 consultation record, not all NPDES-permitted facilities are likely to undergo section 7 consultation. Accordingly, the analysis assumes that 25 percent of major facilities and 20 percent of minor facilities will incur costs, based on an EPA study examining the economic impact to facilities of the temperature regulations. The volume count of activities per watershed is adjusted to reflect this probability.

⁵⁹ Science Applications International Cooperation: *Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon*. Science Applications International Corporation. Reston, VA. 2003. EPA No. 68-C-99-252.

Temporal Distribution

- The analysis assumes that consultations related to temperature compliance will occur immediately (with the probabilities specified above).

Caveats

- EPA's study assumed that facilities in designated spawning and rearing watersheds would incur temperature management costs.

4.4.2.10 Sand and Gravel Mining

Cost estimates

- Sand and gravel mining: \$800,000 (\$0 to \$1,600,000). Sand and gravel mining activities typically require USACE permits under section 401 and 404 of the Clean Water Act. This analysis estimates the cost of gravel forgone due to section 7 implementation using a case study. In this case study, a loss in net revenues of approximately \$11,000 per mile annually was estimated, assuming no substitution of alternate sites, for a total value of \$1.6 million for the whole site over 30 years. Because some projects are unlikely to require modifications for salmon (for example, if they occur on non-fish-bearing streams or outside the Pacific salmon and *O. mykiss* spawning season), this analysis assumes that each site has a 50 percent probability of being required to modify its operations.

Spatial Distribution

- Locations of ongoing and potential mining sites were identified using latitude/longitude data from the USGS "Active Mines and Mineral Plants" (1997).

Temporal Distribution

- This analysis assume there exists an equal probability of consultation beginning in each year over the next 30 years.

Caveats

- This analysis may overstate the likelihood of consultations on sand and gravel mining because not all active and potential mine sites are likely to bear costs for salmon conservation measures. The likelihood of future consultation at a particular site depends on the several factors including the season in which mining activity occurs and the proximity of the mine to fish-bearing streams.

4.4.2.11 Residential and Commercial Development

Cost estimates

- Residential and Commercial Development: \$235,000 (\$230,000 to \$240,000). Development projects are typically required to have a consultation through a connection with stormwater permits. This estimate represents the midpoint of a range of costs associated with constructing a stormwater management plan that conforms with salmon requirements. This includes costs of the stormwater pollution prevention plan, permanent stormwater site plan, and stormwater best management practice operation and maintenance.

- Based on the section 7 consultation record, not all permit applications undergo section 7 consultation. Accordingly, the analysis applies a probability of six percent, representing the proportion of all permits likely to undergo consultation in each watershed relative to the total number of permits in each watershed potentially burdened by consultation. This probability is based on a review of State-issued NPDES stormwater permits resulting in section 7 consultation with the Seattle District of the USACE over the past three years. As a result, six percent of all projected State permits in each watershed are presumed to be burdened by section 7 consultation and related compliance costs.

Spatial Distribution

- As a proxy for the location of development activities potentially burdened by compliance requirements, the analysis employs recent NPDES stormwater permit data by State for residential and commercial development. Specifically, the analysis assumes that the number and location of future development activities constrained by Pacific salmon and O. mykiss protections are reasonably approximated by the proportion of NPDES stormwater permits resulting in consultation in the past.

- These historical permit data were collected from the Washington Department of Ecology, Oregon Department of Environmental Quality, and EPA Region 9 and 10. Industrial permit data were excluded, as this activity is captured through the analysis of EPA water quality regulations, utility, and in-stream projects. In general, the analysis relies on approximately three years of State NPDES stormwater permit data.

Temporal Distribution

- For the purposes of this analysis, it is assumed that consultation related to projected permit applications will occur sometime within the next 20 years. An equal probability is assigned to this consultation beginning in each year over the next 20 years.

Caveats

- Availability of historic permit data varies by State.

4.5 Summary

Table 4-7 below summarizes the cost estimates for the different types of activities.

Table 4-3 SUMMARY OF ACTIVITY COST ESTIMATION							
Activity	Sub-activity	Cost Unit	Midpoint Cost Estimate	Present Value of Cost Stream	Forecast Period	Likelihood of Modifications	Annual Expected Cost
Hydropower Dams*	Small (0 - 5 MW)	per dam	\$2,120,000	\$1,123,000	20 years	10% over 20 years	\$10,600
	Medium (5 - 20 MW)		\$5,750,000	1,915,868	50 years	100% over 50 years	\$138,800
	Large (>20 MW), fish passage unknown		\$56,390,000	\$34,593,394	50 years	100% over 50 years	\$2,506,632
	Unknown capacity		\$7,530,000	\$2,505,732	50 years	100% over 30 years	\$181,565
Non-hydropower Dams	Federal and large non-hydropower dams	per dam	\$2,120,500	\$1,123,000	20 years	100% over 20 years	\$106,025
	Small non-Federal Non-hydropower dams					10% over 20 years	\$10,603

Table 4-3 SUMMARY OF ACTIVITY COST ESTIMATION							
Activity	Sub-activity	Cost Unit	Midpoint Cost Estimate	Present Value of Cost Stream	Forecast Period	Likelihood of Modifications	Annual Expected Cost
Federal Land Management Activities	Northern California	per acre	\$8.95	\$8.95	1 year	100%	\$8.95
	Southern California		\$12.16	\$12.16			\$12.16
Livestock Grazing on Federal Land	Grazing	per acre	\$29.00	\$20	10 years	100% over 10 years	\$2.90
Transportation**	Bridges & culverts (small)	per project & mile	\$27,800 + variable costs (dependent on size of project)	project specific	5 years	100% over 5 years	project specific
	Bridges & culverts (medium)		\$55,500 + variable costs	project specific			project specific
	Bridges & culverts (large)		\$84,300 + variable costs	project specific			project specific
	Roads (small)	per project & mile	\$22,800 + variable costs	project specific	5 years	100% over 5 years	project specific
	Roads (medium)		\$47,000 + variable costs	project specific			project specific
	Roads (large)		\$71,300 + variable costs	project specific			project specific

Table 4-3 SUMMARY OF ACTIVITY COST ESTIMATION							
Activity	Sub-activity	Cost Unit	Midpoint Cost Estimate	Present Value of Cost Stream	Forecast Period	Likelihood of Modifications	Annual Expected Cost
Utility Lines	Outfall structures and pipelines	per project	\$101,000	\$75,388	8 years	100% over 8 years	\$12,625
Instream Activities	Dredging	per project	\$821,000	\$612,000	8 years	100%	\$102,325
	Dredging of San Francisco Bay	per project	\$651,000	\$485,914	8 years	100%	\$81,375
	Boat dock, boat ramps, bank stabilization	per project	\$54,500	\$40,679	8 years	100%	\$6,813
EPA Water Quality Temperature Compliance	Minor facility	per facility	\$136,000	\$72,039	20 years	20%	\$1,360
	Major facility	per facility	\$816,000	\$630,467	20 years	25%	\$14,878
Sand and Gravel Mining	Mining on non-Federal lands	per site	\$800,000	330,908	30 years	50% over 30 years	\$13,333

Table 4-3 SUMMARY OF ACTIVITY COST ESTIMATION							
Activity	Sub-activity	Cost Unit	Midpoint Cost Estimate	Present Value of Cost Stream	Forecast Period	Likelihood of Modifications	Annual Expected Cost
Residential and Commercial Development	New development	per project	\$235,000	\$124,480	20 years	100% over 20 years	\$11,750
*Data for hydropower dams do not allow us to allocate all costs over an expenditure period. The cost stream presented is the present value of costs. **Transportation costs are presented for a project of average mileage (3.2 miles).							

Section 5

The Economic Impacts of Critical Habitat Designation

5.1 Introduction

This section presents a summary of the economic impacts of critical habitat designation for the seven ESUs of Pacific salmon and O. mykiss considered in this analysis. Because of the large numbers of watersheds and nearshore areas that constitute the particular areas, the results are summarized by showing their range and other summary statistics for each ESU.

This section first discusses the aggregation of individual activity impacts into a total impact for each area, and some qualifications on the results. It then examines two different ways of grouping types of impacts that provide useful economic information to the exclusion process. Finally, this section presents a summary of the results for each ESU. The full set of results is given in a series of appendices. Appendix F.1 lists the annual total impact for all individual watersheds, grouped by ESU, for the six cases (three cost estimates and two discount rates). Appendices F.2 through F.12 list cost estimates for individual activities for all watersheds, again grouped by ESU.

As noted, the 4(b)(2) exclusion process operates at the level of a particular watershed, not at the level of the designation as a whole. For that reason, the variation of impacts across areas is an important factor in conducting that process. To illustrate this variation, this section presents a series of figures identifying areas which fall into different impact categories. These categories are for illustrative purposes only, however, as the 4(b)(2) procedure used the impact estimate, not the category. A graphical depiction of these results is presented in the Maps Appendix.

5.2 Aggregating Impacts Up to the Watershed Level

As noted in Section 2 of the report, the ideal measure of the economic impact of a regulatory action is the change in economic surplus that occurs as a result of the action. Using this measure is not feasible in this case, as the economic models and data to population those models are not available. Instead, this analysis applies a straightforward "unit-cost" approach to estimate the aggregate impacts for each area. Using the spatial data described in Section 4 above, the annual volume of an activity type in a particular area is estimated. Where an activity has different sub-types or scales, a separate volume was estimated for each. This analysis then uses the annual expected modification cost to calculate the economic impact of critical habitat designation for a particular area, using the following formula:

$$\text{Aggregate Annual Impact for Watershed (\$/yr)} = \text{Sum (over all Activity Types)} \left[\text{Volume of Activity Type} \times \text{Per-project Impact Cost} \right]$$

Two important elements of this estimation warrant closer examination: variation in the discount rate and uncertainty over nominal modification costs. Both of these are considered in the following ways. First, using the guidance from OMB, a three percent discount rate is substituted for the seven percent discount rate used in the base case calculations.⁶⁰ Second, using the ranges of nominal modification costs (where available) described in Section 4 and Appendix D, a Low and High case are estimated for the annualized expected per-unit costs. For both cases, the estimates are substituted into the equation above.⁶¹ This produced six cases, using the two discount rates and three nominal cost estimates (Midpoint, High, and Low).

Although the high and low ends of the nominal cost range are used to produce an upper and lower bound for the aggregate costs, the probability that these bounds will be reached is vanishingly small. The range is not produced by true, uniform uncertainty over the cost estimate. If the cost estimate was distributed in this way, the probability of the true cost being equal to the high or low end of the range would be equal to the probability of it being equal to the midpoint of the range, which represents the base case in this analysis. Instead, the range is produced by actual variation in the underlying determinants of modification costs, such as project location, scale, history, and so forth. The cost of an individual project's modifications may in fact reach the upper or lower bound, but only in a fraction of the cases. For the upper and lower bounds of the aggregate impact costs to be reached, every project would have to have the necessary characteristics to reach the upper or lower bound on an individual basis, which is not the case. Nevertheless, this information is presented to illustrate how variation in the underlying nominal costs produces variation in the estimates of aggregate impacts for a particular area.

Another aspect of the aggregation method that warrants comment is the implicit assumption that there are no cumulative or regional effects. This report does not provide alternative estimations in this case, however, for the reason stated previously: Adequate data are not available to support the models and analysis needed to examine such effects. Nevertheless, it is important to discuss the possible limitations this assumption places on the analysis.

The use of a constant per-unit cost is best suited to a situation in which the impacts of a regulation are "small": that is, one in which the accumulation of areas or entities that fall under the regulation do not change either the aggregate level of activity or the per-unit cost itself. At first glance, looking ahead to the results presented later in this section, this would not seem to be the case for the impacts of critical habitat designation for Pacific salmon and O. mykiss. Yet the magnitudes of the impacts alone do not necessarily imply that the simpler per-unit approach is inappropriate. Two other factors are more determinative: the concentration of the impacts in terms of the industries and markets

⁶⁰ OMB, 2003.

⁶¹ Uncertainty over the estimated volume of projects was not determined. The use of the chosen spatial data and the projection methods do not allow for analytical derivation of a range.

affected, and the practicality of using more sophisticated models to gauge the cumulative impacts at a regional scale. As noted previously, the second factor works against examining cumulative impacts. The first factor reinforces this conclusion.

Using sophisticated models such as input-output models or estimations of changes in economic surplus require a clear, quantifiable link between the regulation and a change in the availability or cost of a set of economic goods and services. In some previous analyses of critical habitat designation, such a link existed (or was at least assumed to exist). In the case of the northern spotted owl, for example, the economic analysis attributed a precise percentage reduction in Federal timber harvest in certain areas to critical habitat designation.⁶² This assumption allowed the analysis to estimate the impacts of the designation on regional levels of employment and County revenues.

Specifying the link between critical habitat designation and a change in an economic good or service so precisely is not possible for the Pacific salmon and O. mykiss designations. In the Initial Regulatory Flexibility Analysis for this rulemaking, NOAA Fisheries discusses the impacts of the designations on small entities. In that report, NOAA identifies a set of links between the different types of activities identified here and different industry groups that may bear the cost of some of the impacts to those activities. These links are presented in Table 5-1.

In some cases, the link between the activity and an industry is direct and quantifiable. For example, the link between hydropower dams and power markets is one that could be incorporated into a broader regional study. Working against this possibility, however, are the large number of dams and the need to document certain modifications (*e.g.*, changes in flow) on an individual basis, when these modifications are highly uncertain prospectively. Thus, the data needed to support such an effort are not available even in this case.

In other cases, the links are less direct and harder to quantify. Modifications to transportation, utility lines, and instream activities, for example, affect firms that either own the affected assets or are hired to build, maintain, or modify them, but the modifications do not directly affect the flow of a given input or output. In cases like these, data to identify and quantify the links from the impacted activities to market inputs or outputs are not available, and so assessing the impacts at a regional level would be tantamount to a simulation exercise.

This leaves us with uncertainty over the presence of any potential bias from the decision not to consider cumulative impacts at the regional level. On the one hand, if these impacts in fact exist, the direction of the bias in results is downward, in that costs of critical habitat designation are underestimated at the level of the ESU. On the other hand, other potential sources of bias exist that would produce an overestimate of the impact, as discussed in several instances above and in greater detail in Appendix D. The aggregate direction of these potential biases is therefore unknown.

⁶² M.L. Schamberger, J. J. Charbonneau, M. J. Hay, and R. L. Johnson, *Economic Analysis of Critical Habitat Designation Effects for the Northern Spotted Owl*, 1992.

Table 5-1 INDUSTRY GROUPS AND CRITICAL HABITAT DESIGNATION IMPACTS	
Type of Activity Impacted by Critical Habitat Designation	Industry Groups associated with Impacted Activity
Hydroelectric dams	Hydroelectric power generation NAICS 22111
Non-hydropower Dams	Water Supply and Irrigation Systems NAICS 22131
Federal Lands Management	Forestry and Logging NAICS 113
Grazing	Beef Cattle Ranching & Farming NAICS 112111
Transportation	Highway, Street, and Bridge Construction NAICS 237310
Utility Lines	Electric Services NAICS 2211
	Natural Gas Distribution NAICS 221210
	Sewage Treatment Facilities NAICS 221320
Instream Activities	Construction-General, Water, Sewer, Pipeline, Communication & Powerline Construction NAICS 237110, 237120, 237130
	Marinas NAICS 713930
Dredging	Heavy Construction SIC 1629
NPDES-permitted Activities	Fishing, Hunting, Trapping NAICS 114
	Food and Kindred Products NAICS 311
	Sewage Services NAICS 221320
	Paper Mills NAICS 322121, 322122
	Pulp Mills NAICS 322110
	Lumber and Wood Products NAICS 321
Mining	Construction Sand and Gravel Mining NAICS 212321
Residential and Commercial Development	Subdividers and Developers SIC 6552

There is no evidence, of course, that cumulative impacts are present in significant amounts. This absence of evidence is not, however, evidence that they do not exist, but it does suggest that attempting to document these effects, given the analytical barriers, is of questionable value. NOAA recognizes that the absence of this analysis possibly biases the results downward, although there is no way to gauge the likelihood or magnitude of this potential bias.

5.3 Differentiating Types of Impacts

In addition to estimating the total impact of critical habitat designation for each watershed, two different methods for grouping activity types. The first differentiates activity types by the degree to which the modification costs will be borne locally or in a broader area. This grouping is useful for discerning the possibility that critical habitat designation may impose an inequitable burden on individual watersheds. The second grouping differentiates activity types by their probable location within certain watersheds that serve as major migratory corridors. In these cases, NOAA Fisheries is considering the migratory and non-migratory (that is, tributary) areas separately, and the second grouping is intended to support that consideration.

When analyzing the costs of designating a particular area as critical habitat, the standard approach is to consider the impacts from a national perspective, in that the location and concentration of the impacts does not influence economic efficiency.⁶³ The location and concentration of impacts may in part determine the equity of the regulation, however. To support consideration of this issue, the set of activity types are divided into two types: those likely to have economic impacts locally and those likely to have economic impacts at a broader geographic scale.⁶⁴ For each activity, this analysis judged the extent to which employment would be drawn from local labor markets and output would be consumed locally, and the extent to which the entity affected was local or non-local in nature. This division is presented in Table 5-2.

The most logical candidates for non-local impacts are hydropower dams (for which the impact may be absorbed in the broader market for electricity), transportation projects (which are most often funded at the Federal or State level), and Federal lands management (which is funded at the Federal level). This analysis does not assume that the impacts of all projects within these categories are felt non-locally, only that as a category they are more likely to produce that result.

⁶³ This approach is recommended by OMB (2003) and EPA (2000).

⁶⁴ This division was made using best professional judgment. NOAA intends to refine this division and welcomes comment on data and methods for doing so.

Table 5-2 ACTIVITY TYPES WITH LOCAL AND NON-LOCAL IMPACT	
Local Impact Activity Types	Non-local Impact Activity Types
Non-hydropower dams Federal Lands Grazing Permits Utility Line Projects Instream Activities Dredging Projects NPDES-permitted activities Sand & Gravel Mining Residential and Commercial Development	Hydropower dams Federal Lands Management Transportation Projects

The second type of grouping categorized activity types by the location of the activity within the watershed. NOAA Fisheries is considering the designation of only the migratory corridor within a watershed and the exclusion of the tributary areas. If this course is followed, only a portion of the estimated impacts (that is, those associated with the migratory corridor) would be attributable to critical habitat designation. The original estimation of the location of activity types did not differentiate the location within a watershed, however. Similar to our approach above, this analysis identifies types of activities that were more likely to be located along migratory corridors.⁶⁵ In this case, the analysis considers what types of activities are unlikely to occur in large, mainstem rivers. The analysis also draws on discussions with NOAA biologists familiar with section 7 consultations. Again, the division is categorical, which presumes a higher likelihood of being present in one area or another, but not a certainty. Table 5-3 presents the migratory and tributary grouping of activities.

Table 5-3 ACTIVITY TYPES AND LOCATION	
Activity Types located in tributary areas	Activity Types located in migratory corridors
Mining Transportation Federal Lands Grazing Non-hydropower dams Development	Utility Dredging Instream Activities NPDES-permitted activities Hydropower dams

⁶⁵ This division was made using best professional judgment. NOAA intends to refine this division and welcomes comment on data and methods for doing so.

5.4 Summary of the Results for 7 Pacific Salmon and O. mykiss ESUs

Below, a brief narrative covering the results is presented for each ESU, followed by a series of tables, and finally by a figure illustrating the basic results. Our emphasis is on illustrating the variation in the impact of section 7 and critical habitat designation for individual watersheds in each ESU. As has been noted many times, the number of particular areas considered in the report is quite large, making a detailed discussion of each area's result impractical.⁶⁶ Our summary includes several important aspects of the results, including:

- 1) The total impact of the designation for the ESU overall;
- 2) The distribution across activity types of the total impact for the ESU;
- 3) The average, median, maximum, and minimum total impact for the individual watersheds in an ESU; both annually and as a present value over a 20-year period⁶⁷; and the sensitivity of the total impacts to variation in cost estimates and discount rates; and
- 4) The frequency of annual total impacts by cost category for individual watersheds in an ESU.

For most of these, results for each of the six cases are listed: High/Mid/Low refers to the per-project cost estimate, and seven percent/ three percent refers to the discount rate.

This report also illustrates the total impacts at the individual watershed level by presenting a series of maps that display the impacts as categories of cost levels.⁶⁸ Categories to illustrate were chosen based on the variation in impacts at the watershed level across each ESU. These categories were not used in the 4(b)(2) process, as their choice would be arbitrary given the continuous nature of the impact estimates.

Lastly, it is important to recognize that the impacts listed in these tables stem from the implementation of section 7 for activities that modify habitat, not just the incremental impacts of critical habitat designation alone. As noted above, the NMCA decision called for an analysis of "all of the economic impacts of a critical habitat designation, regardless of whether those impacts are

⁶⁶ Appendices F.1 to F.12 contain the full set of results for all watersheds, grouped by ESU. This set includes total, local and non-local, and migratory and tributary impacts for each of six cases (three per-project cost estimates and two discount rates), as well as the individual activity cost estimates presented in the same way.

⁶⁷ Because the data underlying the cost estimates varies widely in terms of the forecast period, the 20-year present value should be seen as illustrative.

⁶⁸ These maps, Figures 9 to 16, are included in the Map Appendix.

attributable co-extensively to other causes.”⁶⁹ The estimates of impacts should then be interpreted as the sum of two types of impacts:

- Co-extensive impacts, or those that are associated with habitat-modifying actions covered by both the jeopardy and adverse modification standards; and
- Incremental impacts, or those that are solely attributable to critical habitat designation and would not occur without the designation.

⁶⁹ New Mexico Cattle Growers’ Association v. U.S. Fish and Wildlife Service, 248 F.3d 1277 (10th Cir. 2001).

5.4.1 California Coastal chinook salmon

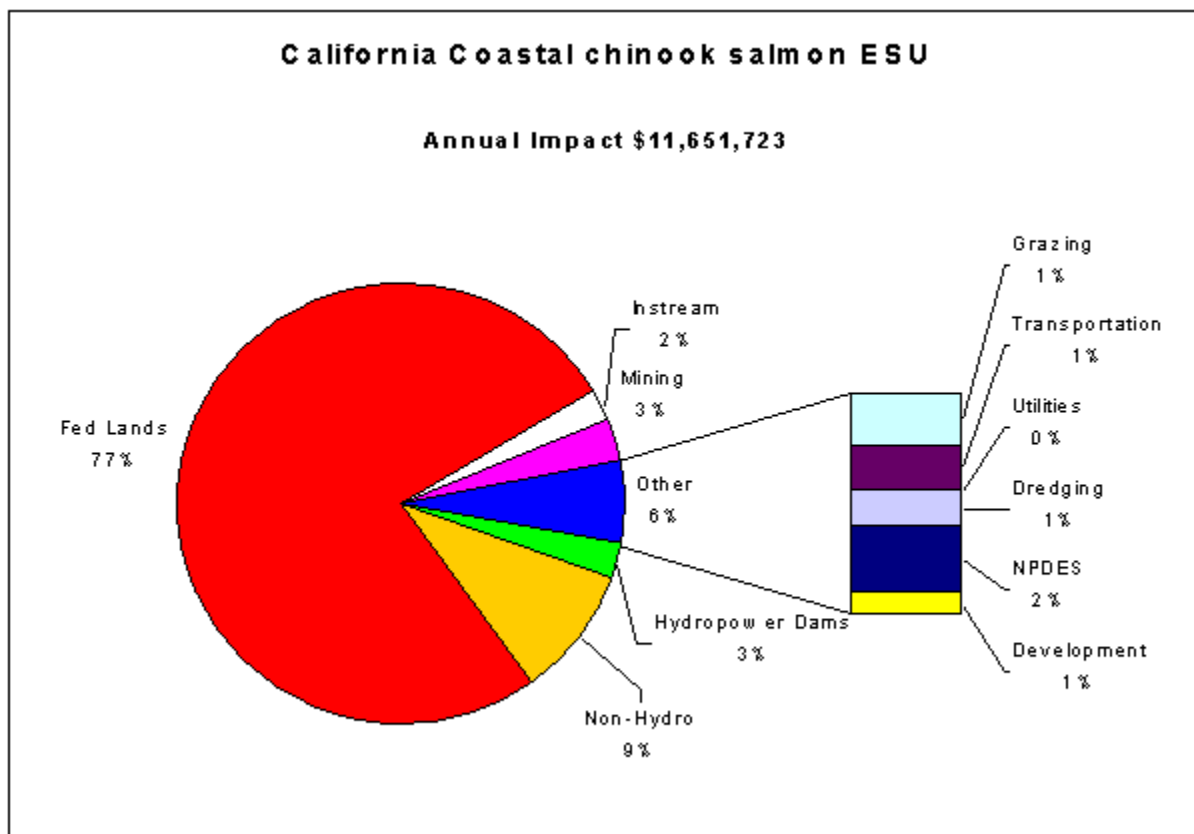
5.4.1.1 Watershed Characteristics

For this ESU, the analysis covers 47 watersheds, averaging 158 square miles in size and ranging from three to 413 square miles. The estimated total population for this ESU is 428,651 and the estimated total personal income is \$13,066,000.

5.4.1.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$18,015,283
Mid 7%	\$11,651,723
Low 7%	\$5,286,793
High 3%	\$17,952,763
Mid 3%	\$11,602,446
Low 3%	\$5,250,824

5.4.1.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.1.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$247,909.
- The highest annual total impact at the watershed level is \$2,634,115 for Lake Pillsbury, while the lowest non-zero total watershed impact is \$1,360 for both North Fork Mad River and Wages Creek; five watersheds are expected to experience zero impact.
- The activity with the highest impact is Federal Lands Management which averages \$189,917 across all watersheds in this ESU and ranges from \$0 to \$2,283,515.
- The activity with the lowest impact is Utility lines which has no impact within the watersheds comprising this ESU.
- Two watersheds have annual total impacts of more than \$1 million, while 22 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$383,304	\$107,895	\$4,034,048	\$0
Mid 7%	\$247,909	\$67,335	\$2,634,115	\$0
Low 7%	\$112,485	\$16,711	\$1,233,294	\$0
High 3%	\$381,974	\$107,895	\$4,018,793	\$0
Mid 3%	\$246,861	\$67,335	\$2,625,664	\$0
Low 3%	\$111,720	\$16,711	\$1,231,690	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	39	39	33	33	29	29
\$200,000 - \$500,000	6	6	8	8	7	7
\$500,000 - \$1,000,000	1	1	4	4	6	6
\$1,000,000 - \$2,500,000	1	1	1	1	4	4
> \$2,500,000	0	0	1	1	1	1

5.4.2 Central Valley spring-run chinook salmon

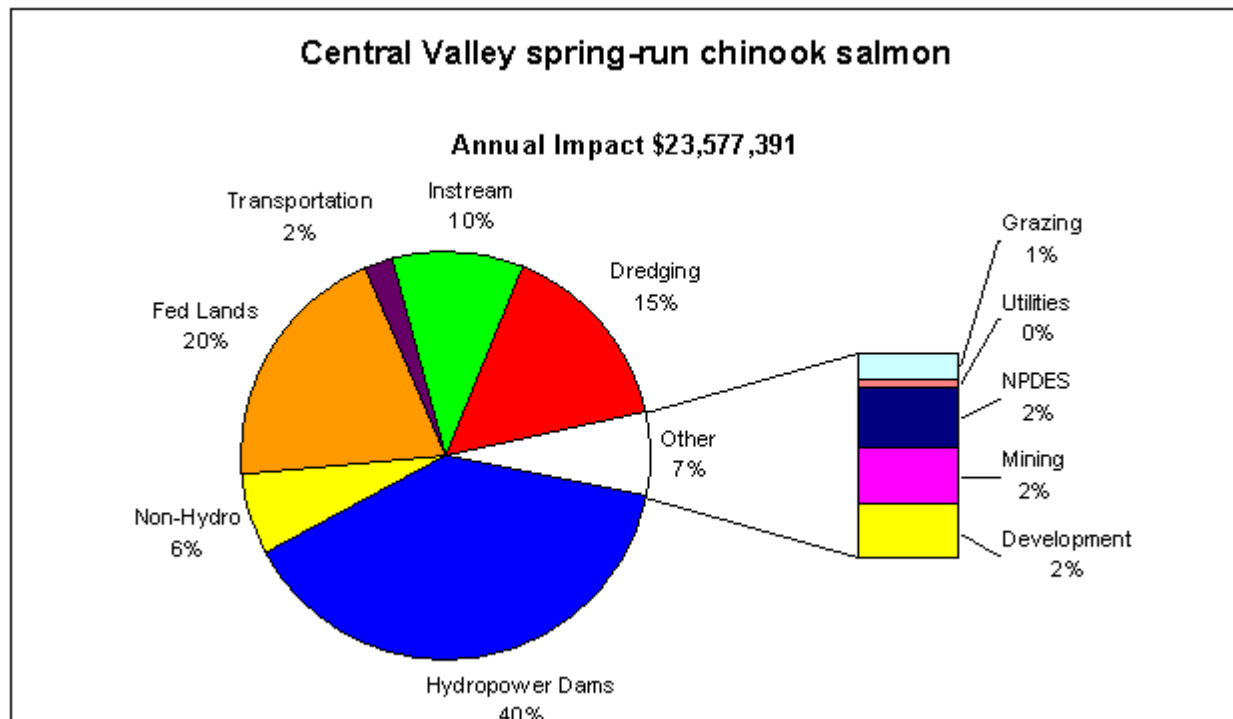
5.4.2.1 Watershed Characteristics

For this ESU, the analysis covers 37 watersheds, averaging 219 square miles in size and ranging from 15 to 1,074 square miles. The estimated total population for this ESU is 1,757,987 and the estimated total personal income is \$50,141,000.

5.4.2.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$38,990,850
Mid 7%	\$23,577,391
Low 7%	\$8,158,872
High 3%	\$34,660,056
Mid 3%	\$21,155,599
Low 3%	\$7,646,234

5.4.2.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.2.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$637,222.
- The highest annual total impact at the watershed level is \$5,385,817 for Lower Feather River, while the lowest is \$919 for Colusa Trough.
- The activity with the highest impact is hydropower which averages \$246,347 across all watersheds in this ESU and ranges from \$0 to \$5,279,909.
- The activity with the lowest impact is utility lines which averages \$2,047 across all watersheds in this ESU and ranges from \$0 to \$37,875.
- Six watersheds have annual total impacts of more than \$1 million, while 10 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$1,053,807	\$640,126	\$9,683,126	\$939
Mid 7%	\$637,227	\$422,799	\$5,385,817	\$919
Low 7%	\$220,510	\$146,148	\$1,146,904	\$900
High 3%	\$936,758	\$636,317	\$6,853,762	\$939
Mid 3%	\$571,773	\$422,799	\$3,818,015	\$919
Low 3%	\$206,655	\$143,643	\$1,138,313	\$900

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	22	22	14	14	12	12
\$200,000 - \$500,000	12	11	6	5	4	4
\$500,000 - \$1,000,000	2	2	11	12	10	10
\$1,000,000 - \$2,500,000	1	2	4	4	8	8
> \$2,500,000	0	0	2	2	3	3

5.4.3 Central California Coast O. mykiss

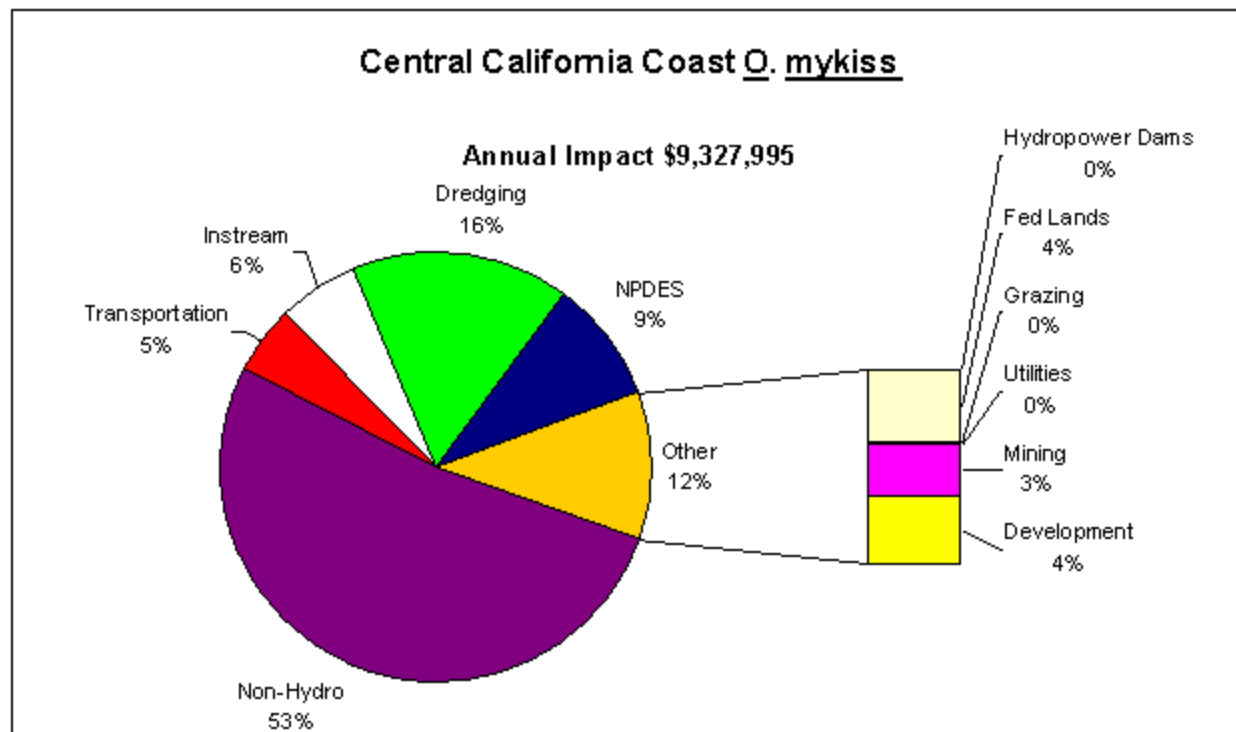
5.4.3.1 Watershed Characteristics

For this ESU, the analysis covers 47 watersheds, averaging 126 square miles in size and ranging from 15 to 635 square miles. The estimated total population for this ESU is 5,741,401 and the estimated total personal income is \$274,221,000.

5.4.3.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$16,052,570
Mid 7%	\$9,327,995
Low 7%	\$2,603,336
High 3%	\$15,902,736
Mid 3%	\$9,178,161
Low 3%	\$2,453,502

5.4.3.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.3.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$198,468.
- The highest annual total impact at the watershed level is \$684,401 for Napa River, while the lowest non-zero total watershed impact is \$1,360 for Estero Americano; six watersheds are expected to experience zero impact.
- The activity with the highest impact is non-hydropower dams which averages \$103,318 across all watersheds in this ESU and ranges from \$0 to \$561,933.
- The activity with the lowest impact is utility lines which has no impact within the watersheds that comprise this ESU.
- No watersheds have annual total impacts of more than \$1 million, and 15 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$341,544	\$205,526	\$1,251,044	\$0
Mid 7%	\$198,468	\$113,479	\$684,401	\$0
Low 7%	\$55,390	\$36,844	\$224,842	\$0
High 3%	\$338,356	\$205,526	\$1,245,316	\$0
Mid 3%	\$195,280	\$111,345	\$678,674	\$0
Low 3%	\$52,202	\$36,844	\$221,979	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	45	45	29	28	23	23
\$200,000 - \$500,000	2	2	13	13	12	12
\$500,000 - \$1,000,000	0	0	5	6	7	7
\$1,000,000 - \$2,500,000	0	0	0	0	5	5
> \$2,500,000	0	0	0	0	0	0

5.4.4 California Central Valley O. mykiss

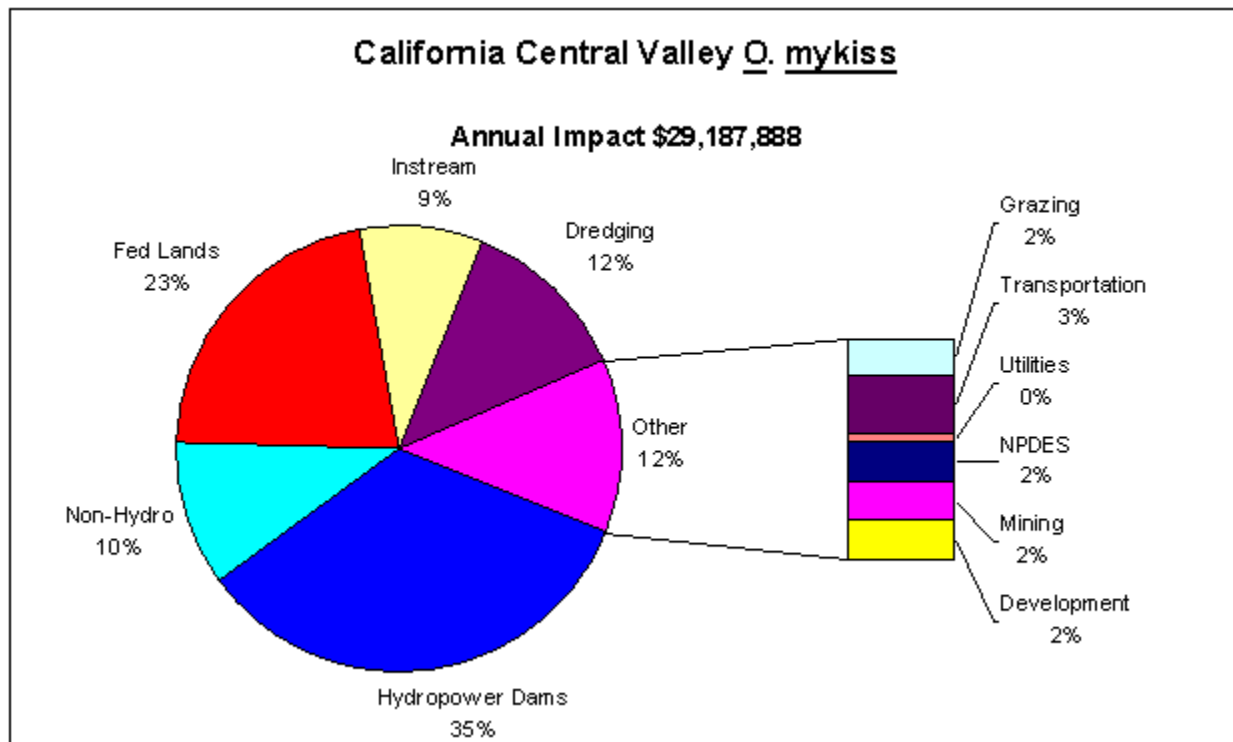
5.4.4.1 Watershed Characteristics

For this ESU, the analysis covers 67 watersheds, averaging 206 square miles in size and ranging from six to 1,074 square miles. The estimated total population for this ESU is 3,041,659 and the estimated total personal income is \$80,952,000.

5.4.4.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$48,152,001
Mid 7%	\$29,187,888
Low 7%	\$10,215,316
High 3%	\$43,723,423
Mid 3%	\$26,695,165
Low 3%	\$9,658,746

5.4.4.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.4.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$435,640.
- The highest annual total impact at the watershed level is \$5,385,817 for Lower Feather River, while the lowest non-zero watershed impact is \$41 for Dye Creek; four watersheds are expected to experience zero impact.
- The activity with the highest impact is hydropower which averages \$146,719 across all watersheds in this ESU and ranges from \$0 to \$5,279,909.
- The activity with the lowest impact is utility lines which averages \$1,696 across all watersheds in this ESU and ranges from \$0 to \$37,875.
- Seven watersheds have annual total impacts of more than \$1 million, while 21 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$718,687	\$266,448	\$9,683,126	\$0
Mid 7%	\$435,640	\$161,492	\$5,385,817	\$0
Low 7%	\$152,467	\$62,157	\$1,146,904	\$0
High 3%	\$652,588	\$266,448	\$6,853,762	\$0
Mid 3%	\$398,435	\$161,492	\$3,818,015	\$0
Low 3%	\$144,160	\$59,293	\$1,138,313	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	50	50	36	36	28	28
\$200,000 - \$500,000	14	13	11	10	12	12
\$500,000 - \$1,000,000	2	2	13	14	13	13
\$1,000,000 - \$2,500,000	1	3	5	5	11	11
> \$2,500,000	0	0	2	2	3	3

5.4.5 Northern California O. mykiss

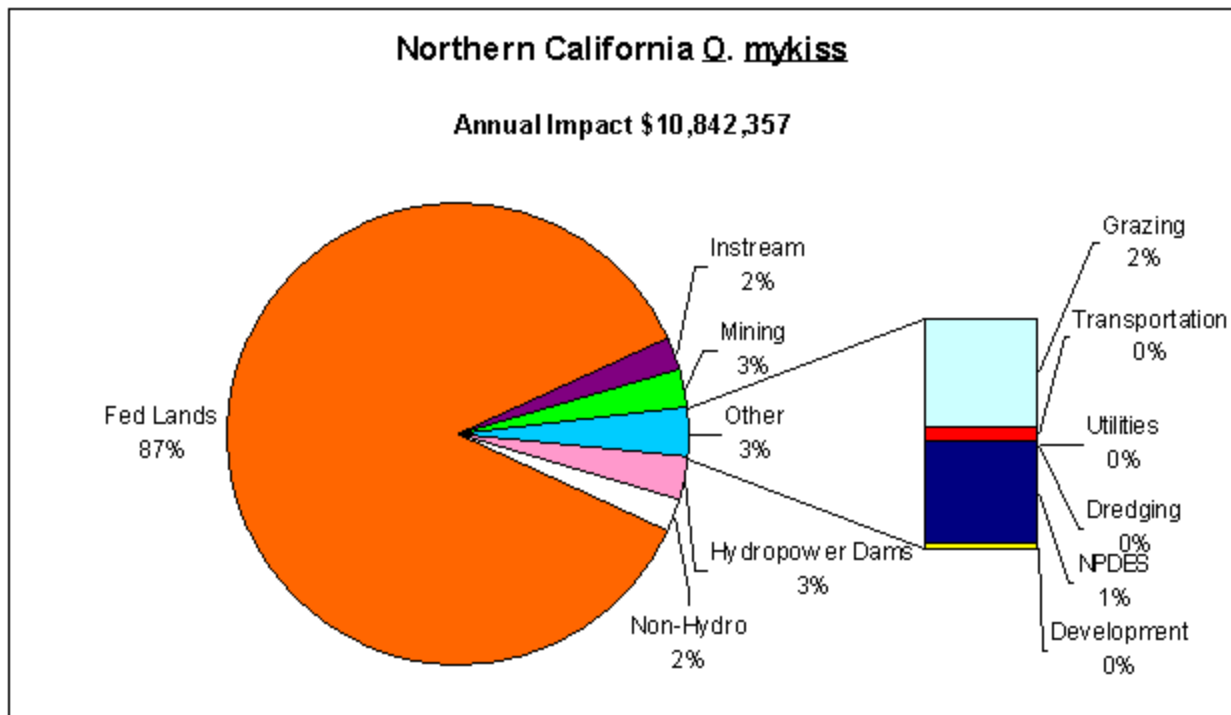
5.4.5.1 Watershed Characteristics

For this ESU, the analysis covers 52 watersheds, averaging 133 square miles in size and ranging from three to 413 square miles. The estimated total population for this ESU is 169,718 and the estimated total personal income is \$4,048,000.

5.4.5.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$16,437,429
Mid 7%	\$10,842,357
Low 7%	\$5,245,831
High 3%	\$16,383,500
Mid 3%	\$10,801,672
Low 3%	\$5,218,453

5.4.5.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.5.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$208,507.
- The highest annual total impact at the watershed level is \$2,634,115 for Lake Pillsbury, while the lowest nonzero watershed impact is \$579 for Weott; 13 watersheds have an impact of zero.
- The activity with the highest impact is Federal Lands which averages \$180,375 across all watersheds in this ESU and ranges from \$0 to \$2,283,515.
- The activity with the lowest impacts are utility lines and dredging which are not expected to experience any impact within the watersheds comprising this ESU.
- Two watersheds have annual total impacts of more than \$1 million, while 32 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$316,104	\$35,618	\$4,034,048	\$0
Mid 7%	\$208,507	\$20,617	\$2,634,115	\$0
Low 7%	\$100,881	\$3,513	\$1,233,294	\$0
High 3%	\$315,067	\$35,618	\$4,018,793	\$0
Mid 3%	\$207,724	\$20,617	\$2,625,664	\$0
Low 3%	\$100,355	\$3,513	\$1,231,690	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	39	39	33	33	29	29
\$200,000 - \$500,000	6	6	8	8	7	7
\$500,000 - \$1,000,000	1	1	4	4	6	6
\$1,000,000 - \$2,500,000	1	1	1	1	4	4
> \$2,500,000	0	0	1	1	1	1

5.4.6 South-Central California Coast O. mykiss

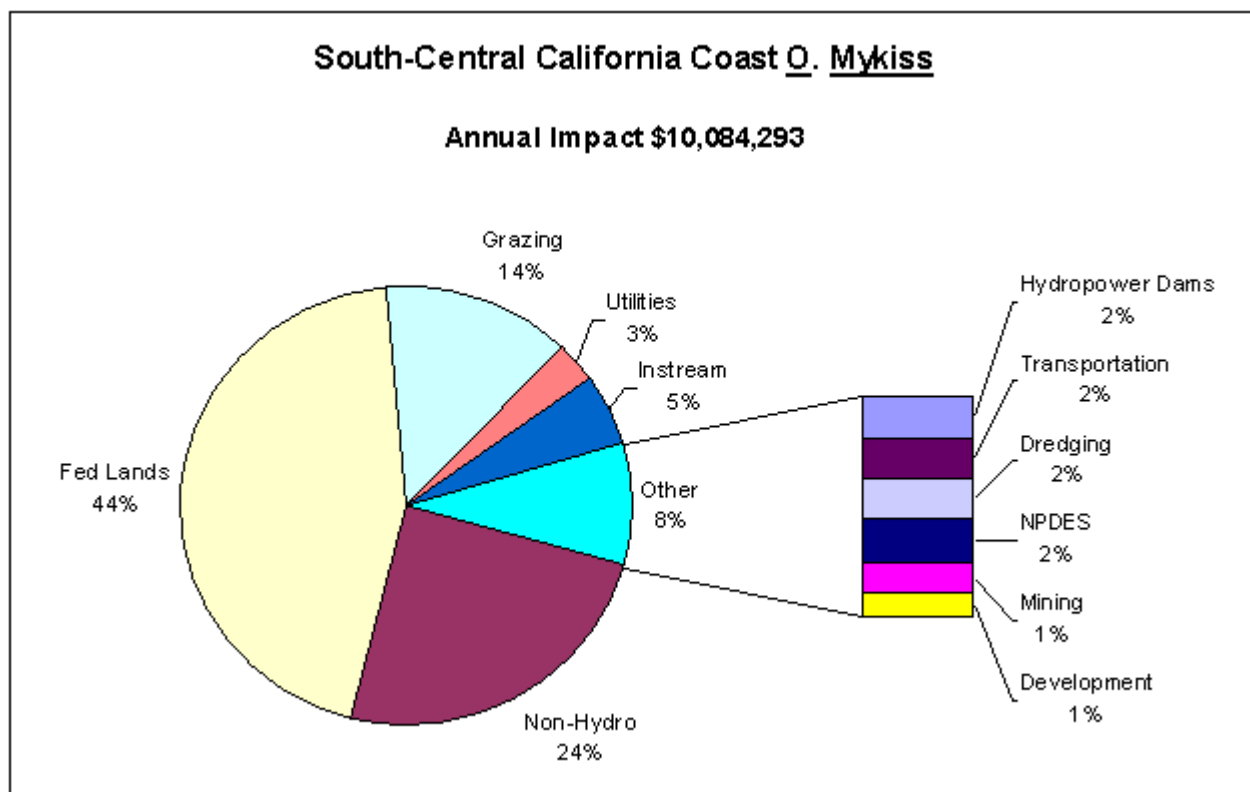
5.4.6.1 Watershed Characteristics

For this ESU, the analysis covers 30 watersheds, averaging 197 square miles in size and ranging from three to 1,495 square miles. The estimated total population for this ESU is 701,525 and the estimated total personal income is \$23,298,000.

5.4.6.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$16,348,516
Mid 7%	\$10,084,293
Low 7%	\$3,819,182
High 3%	\$16,301,760
Mid 3%	\$10,044,341
Low 3%	\$3,786,076

5.4.6.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.6.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$336,143.
- The highest annual total impact at the watershed level is \$2,331,971 for Paso Robles, while the lowest non-zero watershed impact is \$1,388 for San Simeon; one watershed is expected to experience zero impact.
- The activity with the highest impact is Federal lands management which averages \$150,527 across all watersheds in this ESU and ranges from \$0 to \$1,392,110.
- The activity with the lowest impact is development which averages \$3,003 across all watersheds in this ESU and ranges from \$0 to \$24,820.
- Four watersheds have annual total impacts of more than \$1 million, while 10 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$544,951	\$195,577	\$4,233,149	\$0
Mid 7%	\$336,143	\$119,392	\$2,331,971	\$0
Low 7%	\$127,306	\$31,961	\$692,428	\$0
High 3%	\$543,392	\$192,714	\$4,230,285	\$0
Mid 3%	\$334,811	\$116,876	\$2,329,107	\$0
Low 3%	\$126,203	\$30,529	\$692,428	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	23	23	22	22	15	15
\$200,000 - \$500,000	4	4	3	3	8	8
\$500,000 - \$1,000,000	3	3	1	1	2	2
\$1,000,000 - \$2,500,000	0	0	4	4	3	3
> \$2,500,000	0	0	0	0	2	2

5.4.7 Southern California O. mykiss

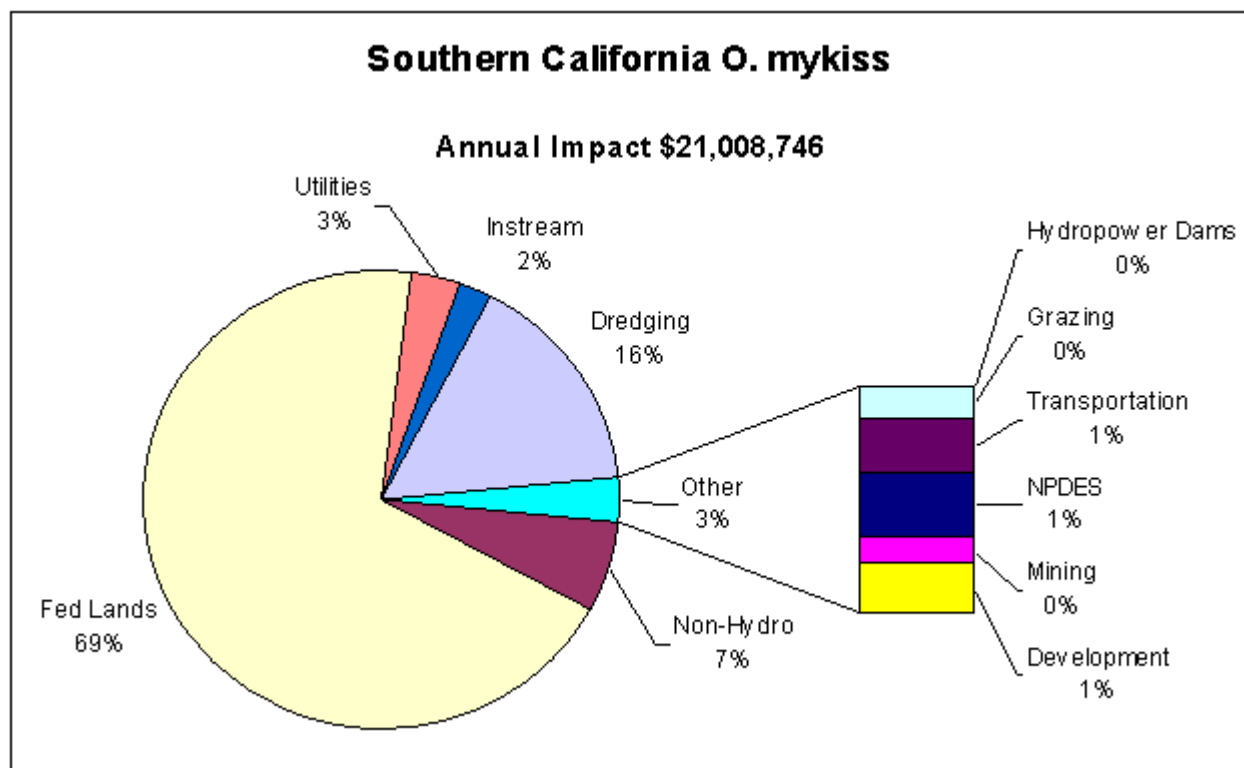
5.4.7.1 Watershed Characteristics

For this ESU, the analysis covers 37 watersheds, averaging 118 square miles in size and ranging from one to 1,145 square miles. The estimated total population for this ESU is 784,002 and the estimated total personal income is \$26,939,000.

5.4.7.2 Economic Impacts of Critical Habitat Designation for the Entire ESU

Case	Annual Total Impact
High 7%	\$32,034,225
Mid 7%	\$21,008,746
Low 7%	\$9,983,267
High 3%	\$31,999,859
Mid 3%	\$20,974,380
Low 3%	\$9,948,901

5.4.7.3 Economic Impacts of Individual Activities for the Entire ESU



5.4.7.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$567,804.
- The highest annual total impact at the watershed level is \$4,684,515 for Cuyama Valley, while the lowest non-zero watershed impact is \$2,070 for Upper Ojai; three watersheds are expected to experience zero impact.
- The activity with the highest impact is Federal lands management which averages \$36,965 across all watersheds in this ESU and ranges from \$0 to \$4,445,408.
- The activity with the lowest impact is hydropower which is expected to experience zero impact in the watersheds that comprise this ESU.
- Six watersheds have annual total impacts of more than \$1 million, while 12 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$865,790	\$264,183	\$7,107,883	\$0
Mid 7%	\$567,804	\$151,743	\$4,684,515	\$0
Low 7%	\$269,818	\$55,847	\$2,261,148	\$0
High 3%	\$864,861	\$264,183	\$7,107,883	\$0
Mid 3%	\$566,875	\$151,743	\$4,684,515	\$0
Low 3%	\$268,889	\$55,847	\$2,261,148	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	26	26	21	21	17	17
\$200,000 - \$500,000	5	5	8	8	9	8
\$500,000 - \$1,000,000	3	3	2	2	3	4
\$1,000,000 - \$2,500,000	2	2	3	3	3	3
> \$2,500,000	1	1	3	3	5	5

5.4.8 Aggregate Impacts for all ESUs

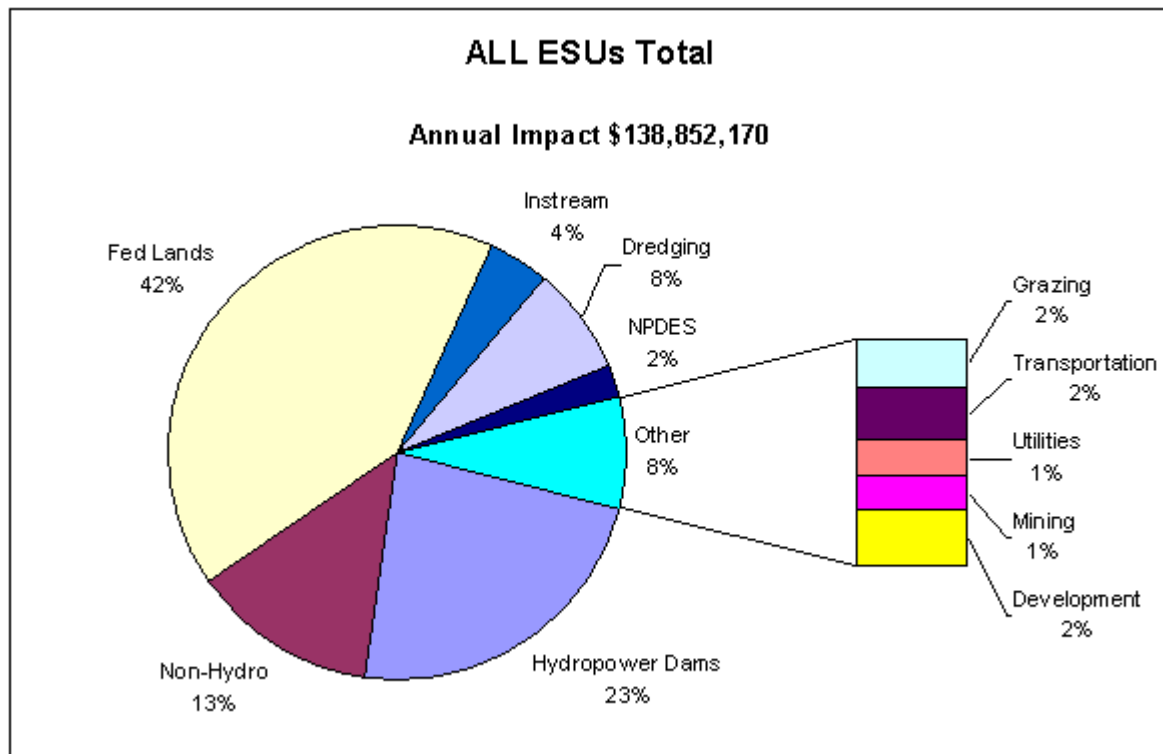
5.4.8.1 Watershed Characteristics

For all seven ESUs, the analysis considered 484 watersheds, averaging 159.3 square miles in size and ranging from 0.6 to 1495.5 square miles. Importantly, these are all the watersheds that were considered for designation and not just the watersheds known to be occupied by one or more of the ESUs. The estimated total population for all watersheds is 10,441,159.

5.4.8.2 Economic Impacts of Critical Habitat Designation for all ESUs

Case	Annual Total Impact
High 7%	\$223,925,100
Mid 7%	\$138,852,170
Low 7%	\$53,741,978
High 3%	\$217,365,054
Mid 3%	\$135,003,594
Low 3%	\$52,606,490

5.4.8.3 Economic Impacts of Individual Activities for all ESUs



5.4.8.4 Economic Impacts at the Watershed Level

At a 7% discount rate and the midpoint per-project cost estimate:

- The average annual total impact at the watershed level is \$286,885.
- The highest annual total impact at the watershed level is \$5,385,817 for Lower Feather River, while the lowest non-zero watershed impact is \$41 for Dye Creek; 87 watersheds are expected to experience zero impacts.
- The activity with the highest impact is Federal lands management, which averages \$119,942 across all watersheds and ranges from \$0 to \$4,445,408.
- The activity with the lowest impact is mining which averages \$3,526 across all watersheds in this ESU and ranges from \$0 to \$133,333.
- 33 watersheds have annual total impacts of more than \$1 million, while 231 have annual total impacts less than \$50 thousand.

Case	Total Annual Impact for Individual Watersheds			
	Average	Median	Maximum	Minimum
High 7%	\$462,655	\$84,886	\$9,683,126	\$0
Mid 7%	\$286,885	\$56,214	\$5,385,817	\$0
Low 7%	\$111,037	\$22,763	\$2,261,148	\$0
High 3%	\$449,101	\$84,367	\$8,711,436	\$0
Mid 3%	\$278,933	\$56,214	\$4,995,225	\$0
Low 3%	\$108,691	\$21,978	\$2,261,148	\$0

Frequency of Annual Total Impacts for Individual Watersheds						
Watershed Annual Total Impact	Low - 3%	Low - 7%	Mid - 3%	Mid - 7%	High - 3%	High - 7%
< \$200,000	405	405	347	356	296	296
\$200,000 - \$500,000	54	53	65	64	85	84
\$500,000 - \$1,000,000	17	16	39	41	43	44
\$1,000,000 - \$2,500,000	7	9	21	21	42	42
> \$2,500,000	1	1	12	12	18	18

Section 6

References

Bakkala, R.G. 1970. Synopsis of biological data on the chum salmon, *Oncorhynchus keta* Walbaum 1792. FAO species synop. No. 41, U.S. Fish. Wild. Serv. circ. 315. 89 p.

Bax, N.J. 1983. The early migration of juvenile chum salmon (*Oncorhynchus keta*) through Hood Canal - its variability and consequences. Ph.D. Dissertation, Univ. of Wash, Seattle, WA. 196 p.

Beamish, R.J., M. Folkes, R. Sweeting and C. Mahnken. 1998. Intra-annual changes in the abundance of coho, chinook, and chum salmon in Puget Sound in 1997. In Puget Sound Research Proceedings 1998, Puget Sound Water Quality Action Team, Olympia. http://www.psat.wa.gov/Publications/98_proceedings/pdfs/4c_beamish.pdf

Beechie, T.J., E.A. Steel, P. Roni, and E. Quimby, 2003. Ecosystem Recovery Planning for Listed Salmon: An Integrated Assessment Approach for Salmon Habitat, NOAA Fisheries, Northwest Fisheries Science Center.

Bonneville Power Administration (BPA), 1992. "Implement Willamette Basin Mitigation Project." BPA Project Number 199206800. Available at <http://173.160.2.246/Environment/EW/PROPOSALS/AIWP/2001/CD/projects/199206800.htm>.

BPA, 2004. FY2005 Congressional Budget, Funding Profile by Subprogram, available at <http://www.bpa.gov/corporate/dfc/conbud/pdf/02a%20Fund%20Profile%20Rev%201-30-04.pdf>

Brookshire, D.S., M. McKee, and G. Watts, 1993. Draft Economic Analysis of Proposed Critical Habitat Designation in the Colorado River Basin for the Razorback Sucker, Humpback Chub, Colorado Squawfish, and Bonytail, U.S. Fish and Wildlife Service, Washington, D.C.

Brookshire, D.S., M. McKee, and C. Schmidt, 1995. Economic Analysis of Critical Habitat Designation in the Virgin River Basin for the Woundfin and Virgin River Chub, U.S. Fish and Wildlife Service, Washington, D.C.

California Department of Conservation, 2001. "California Again Leads the Nation in Production of Non-Fuel Minerals," press release, August 7, 2001, Sacramento, California..

California Department of Water Resources, 1993. Division of Safety of Dams. Dams within the Jurisdiction of the State of California, Bulletin 17

Columbia Basin Bulletin, 2004. "Ninth Circuit Upholds Salmon Pesticide Ban During Appeal," June 25, 2004.

Columbia Basin Bulletin, 2003. "Grant PUD Meets Survival Goals at Two Mid-Columbia Dams," September 26, 2003.

Elliott D. Pollack and Company, 1999. The Economic and Fiscal Impact of the Designation of 60,060 Acres of Privately Owned Land in Pima County, Arizona as Critical Habitat for the Cactus Ferruginous Pygmy-Owl, prepared for Southern Arizona Homebuilders Association.

Environmental Protection Agency (EPA), 2000. Guidelines for Preparing Economic Analyses, EPA-240-R-00-003, Washington, D.C..

EPA, 2003. EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards, EPA 910-B-03-002, Washington, D.C.

Federal Energy Regulatory Commission (FERC), 2001. Hydroelectric Project Licensing Handbook.

FERC, 2003. Wetland and Waterbody Construction and Mitigation Procedures, Washington, D.C.

Fraser, F.J., D.D. Bailey, and M.J. Wood. 1978. Big Qualicum River Salmon Development Project, Vol. 3. Experimental rearing of chum salmon juveniles (*Oncorhynchus keta*) in freshwater (1968-1970). Can. Fish. Mar. Serv. Tech. Rep. 752.

Fish and Wildlife Service (FWS), 2002. Lower Snake River Compensation Plan Office, Annual Report, Fiscal Year 2001, October 1, 2000 - September 30, available at <http://lsnakecomplan.fws.gov/Reports/LSRCP/anreport.pdf>.

FWS, 2004. Final Economic Analysis of Critical Habitat Designation for the Bull Trout, available at http://pacific.fws.gov/bulltrout/final_colkla/pdf/BTFinalEA.pdf

Gold, M.L. J.E. Siegel, L.B. Russell, and M.C. Weinstein, 1996. Cost Effectiveness in Health and Medicine: The Report of the Panel on Cost-Effectiveness in Health and Medicine, Oxford University Press, New York.

Grant County P.U.D., 2004. Figures for Salmon Update 2004, Ephrata, Washington.

Groot, C. and L. Margolis (editors). 1991. Pacific salmon life histories. Univ. B.C. Press, Vancouver, B.C., 564 p.

Hamilton, J. and N. Whittlesey, 1996. Cost of Using Water from the Snake River Basin to Augment Flows for Endangered Species. Presentation to the Snake River Salmon Economics Technical Committee.

Healey, M.C., 1982. Juvenile Pacific salmon in estuaries: the life support system. Pp. 315-341 in V.S. Kennedy (ed.) Estuarine Comparisons. Academic Press, New York, NY. 709 p.

Huppert, D., D.L. Fluharty, E. Doyle, and A. Benyounes, 1996. Economics of Snake River Salmon Recovery: A Report to the National Marine Fisheries Service.

Huppert, D., G. Green, W. Byers, A. Subkoviak, and A. Wenzl., 2004. Economics of Columbia River Initiative, Final Report to the Washington Department of Ecology and CRI Economics Advisory Committee.

Johnson, O.W., W.S. Grant, R.G. Kope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-32, 280 p.

Kohler, S., 2002. "California Non-Fuel Minerals 2002." California Department of Conservation, California Geological Survey, Sacramento, California.

Layton, D., G. Brown, and M. Plummer, 1999. "Valuing Multiple Programs to Improve Fish Populations," Report to the Washington State Department of Ecology.

Loomis, J.B., 1996. "Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River: Results of a Contingent Valuation Survey," *Water Resources Research* 32(2): 441-447.

Marriott, D., and 27 contributors. 2002. Lower Columbia River and Columbia River Estuary Subbasin Summary. Report Prepared for the Northwest Power Planning Council, dated May 17, 2002. Available at: <http://www.cbfwa.org/>.

Martin, D.J., D.R. Glass, C.J. Whitmus, C.A. Simenstad, D.A. Milward, E.C. Volk, M.L. Stevenson, P. Nunes, M. Savvoie, and R.A. Grotefendt. 1986. Distribution, seasonal abundance, and feeding dependencies of juvenile salmon and non-salmonid fishes in the Yukon River Delta. NOAA, OCSEAP Final Rep. 55(1988):381-770. Avail. Arctic Environment Assessment Center, 222 W. 8th Ave., No. 55, Anchorage, AK 99513.

Mazer, J.I., and M.P. Shepard. 1962. Marine survival, distribution and migration of pink salmon off the British Columbia coast. H.R. MacMillan Lectures in Fisheries, Univ. Brit. Col., Vancouver, B.C., Canada, p. 113-121.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42, 156p. Available at <http://www.nwfsc.noaa.gov/publications/techmemos/tm42/tm42.pdf>.

Meyer, S.M., 1998. "The Economic Impact of the Endangered Species Act on the Housing and Real Estate Markets." *New York University Environmental Law Journal*. 6(450):1-13. Mobrand Biometrics, Inc., 1999. The EDT Method.

National Marine Fisheries Service (NMFS), 1995. Biological Opinion, Reinitiation of Consultation on 1994-1998 Operation of the Federal Columbia River Power System and Juvenile Transportation Program in 1995 and Future Years.

NMFS, 1998. Supplemental Biological Opinion, Operation of the Federal Columbia River Power System Including the Smolt Monitoring Program and the Juvenile Fish Transportation Program: A Supplement to the Biological Opinion Signed on March 2, 1995, For the Same Projects.

NMFS, 2000. Biological Opinion, Reinitiation of Consultation on Operation of the Federal Columbia River Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin.

NMFS, 2001. Biological Opinion of Corps of Engineers' Programmatic Consultation for Permit Issuance for 15 Categories of Activities in Oregon, March 21, 2001. OSB2001-0016.

NMFS, 2002. NMFS National Gravel Extraction Policy (draft). Available at <http://www.nmfs.noaa.gov/habitat/habitatprotection/pdf/gravelguidance.pdf>.

NMFS, 2003a. Biological Opinion for Construction of a new boat dock at Columbia Cove Park, Okanogan County, Washington, May 16, 2003. 2001/01013.

NMFS, 2003b. Biological Opinion for McCormick Pier Repair Project, Willamette River Mile 11.3, Multnomah County, Oregon, May 23, 2003. 2002/01399.

NMFS, 2003c. Biological Opinion for Rouge River (Depot Street) Bridge Replacement Project, Jackson County, Oregon, October 23, 2003. 2002/00816.

NMFS, 2003d. Biological Opinion for the Georgia-Pacific Bulkhead Replacement Project, Yaquina River Basin, Lincoln County, Oregon, February 21, 2003. 2002/01314.

NMFS, 2003e. Biological Opinion for the Myrtle Creek and Tri-City Sanitary District Wastewater Treatment Plant Improvement, South Umpqua River, Douglas County, Oregon, April 30, 2003, 2002/00376.

NMFS, 2003f. Biological Opinion for the Port Of St. Helens Industrial Outfall and Portland General Electric Power Plant, Port Westward Industrial Park, Columbia River, Columbia County, Oregon, August 1, 2003. 2002/00013.

NMFS, 2003g. Biological Opinion of Corps for Miller Creek Wastewater Treatment Plant Outfall Replacement, WRIA 9, August 15, 2003, 2002/00355.

NMFS, 2003h. Draft Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Consultation, White River Hydroelectric Project FERC Project Number 2494-002.

NMFS, 2003i. Endangered Species Act Formal Section 7 and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Joe Bernert Towing Company Instream Gravel Mining Project, Lower Willamette River Basin, River Miles 27-56.6, Clackamas, Marion, and Yamhill Counties, Oregon (Corps No. 199601626).

NMFS, 2003j. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for U.S. Forest Service and Bureau of Land Management Programmatic Activities in Northwestern Oregon, NOAA Fisheries, 2002/01254 (FS) and 2002/01880 (BLM).

NMFS, 2003k. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for U.S. Forest Service Programmatic Culvert Replacement Activities in Washington and Eastern Oregon, NOAA Fisheries, 2003/00676.

NMFS, 2004a. Initial Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams For 13 Evolutionarily Significant Units of Pacific Salmon and *O. mykiss*. NOAA Fisheries Northwest Region Report. October 2004. (Available from NOAA Fisheries at <http://www.nwr.noaa.gov/1salmon/salmesa/crithab/CHsite.htm>).

NMFS, 2004b. Memorandum from M. Longenbaugh (NOAA Fisheries) Through S. Landino (NOAA Fisheries) to D. Darm (NOAA Fisheries) re: review of integrated natural resource management plans in WA. September 29, 2004.

NMFS, 2004b. Memorandum from M. Longenbaugh (NOAA Fisheries) Through S. Landino (NOAA Fisheries) to D. Darm (NOAA Fisheries) re: review of integrated natural resource management plans in WA. September 29, 2004.

NMFS, 2004d. Designation of Critical Habitat for West Coast Salmon and Steelhead: Draft 4(b)(2) Report. NOAA Fisheries Northwest Region Report. October 2004. (Available from NOAA Fisheries at <http://www.nwr.noaa.gov/1salmon/salmesa/crithab/CHsite.htm>).

NMFS, 2004e. Memorandum from G. Sims (NOAA Fisheries) to D. Darm (NOAA Fisheries) re: critical habitat and Indian lands. September 28, 2004.

NMFS, 2004f. Draft Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Consultation, License Amendment for Operation of the Baker River Hydroelectric Project (FERC No. 2150) through April 2006, Baker River, HUC 17110007, Skagit and Whatcom Counties, Washington.

NMFS, 2004g. Northwest Salmon Recovery: Integrating Habitat, Hydropower, Harvest and Hatchery Programs with State/Federal/Local Recovery Efforts, Report to Congress.

NMFS, 2004h. State/Tribal Review Draft, Biological Opinion, Operation of the Federal Columbia River Power System including the 19 Bureau of Reclamation Projects in the Columbia Basin (Revised and reissued pursuant to court order, *NWF v. NMFS*, Civ. No. CV 01-640-RE (D. Oregon)).

Northwest Power Planning Council (NPPC), 1997. Alternative Scenarios for Future Hydroelectric Operations: Preliminary Report.

NPPC, 2000. Analysis of Recommendations to Amend the Fish and Wildlife Program Relating to Mainstem Hydroelectric Operations, memorandum from John Fazio.

Northwest Power and Conservation Council (NPCC), 2004. Third Annual Report to the Northwest Governors on Expenditures of the Bonneville Power Administration to Implement the Columbia River Basin Fish and Wildlife Program of the Northwest Power and Conservation Council, 1978-2002, Council Document 2004-3.

Olsen, D., J. Richards, and R. D. Scott, 1991. "Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs," *Rivers* 2(1): 44-56.

Office of Management and Budget (OMB), 2001. Memorandum for Heads of Executive Departments and Agencies, and Independent Regulatory Agencies, M-01-27, Washington, D.C.

OMB, 2003. Circular A-4, Regulatory Analysis, Washington, D.C..

Pacific Coast Salmon Fishery Management Plan. 2000. Amendment 14 to the Pacific Coast Salmon Plan (1997). Available at <http://www.pcouncil.org/salmon/salfmp/a14.html>.

Peterman, R.M. 1978. Testing for density-dependent marine survival in Pacific salmonids. *J. Fish. Res. Board Can.* 35:1434-1450.

Peters, L., 2003. . "ESA Costs for the Hydropower Sector," memorandum to Industrial Economics, Inc.

Puget Sound Energy, 2004. Baker River Hydroelectric Project, FERC No. 2150, Application for New License, Major Project—Existing Dam, Volume I, Part 1 of 2, Exhibits A, B, C, D and H, 18 CFR, Part 4, Subpart F, Section 4.51.

Risk Management Association, 2002. RMA Annual Statement Studies, Philadelphia, Pennsylvania.

Sakuramoto, K., and S. Yamada. 1980. A study on the planting effect of salmon. 1. A mathematical model for the derivation of their rate of return and its applications. *Bull. Jpn. Soc. Sci. Fish.* 46(6):653-661.

Salo, E.O. 1991. Life history of chum salmon, *Oncorhynchus keta*. In C. Groot and L. Margolis (editors), *Pacific salmon life histories*, p. 231-309. Univ. B.C. Press, Vancouver, B.C.

Schamberger, M.L., J.J. Charbonneau, M.J. Hay, and R.L. Johnson, 1992. Economic Analysis of Critical Habitat Designation Effects for the Northern Spotted Owl, U.S. Fish and Wildlife Service, Washington, D.C.

Science Applications International Cooperation, 2003. Economic Analysis of the Proposed Water Quality Standards Rule for the State of Oregon, EPA No. 68-C-99-252, Reston, VA.

Simenstad, C.A., K.L. Fresh, and E.O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. In: V. Kennedy, editor. Estuarine comparisons. Academic Press, New York (343-364).

Spence, B.C., G.A. Lomnický, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (Available at <http://www.nwr.noaa.gov/1habcon/habweb/habguide/ManTech/front.htm>).

U.S. Bureau of Reclamation (USBR), 1999. Snake River Flow Augmentation Impact Analysis Appendix, Prepared for the U.S. Army Corps of Engineers, Walla Walla District's Lower Snake River Juvenile Salmon Migration Feasibility Study and Environmental Impact Statement, United States Department of the Interior, Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho.

U.S. Bureau of Reclamation (USBR), U.S. Army Corps of Engineers (USACE), and Bonneville Power Administration (BPA), 2003. Endangered Species Act 2003 Check-In Report for the Federal Columbia River Power System.

U.S. Department of Agriculture (USDA), 2003. "Economic Impact of Spray Buffers on Agriculture in the Pacific Northwest," Office of the Chief Economist, Washington, D.C.

U.S. Forest Service (USFS) and U.S. Bureau of Land Management (BLM), 2004. Record of Decision, Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests Within the Range of the Northern Spotted Owl Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy.

Washington Department of Ecology (WDOE), 2001. Year 2001 Minimum Requirements for Stormwater Management in Western Washington Cost Analysis, Olympia, Washington. Washington Department of Fish and Wildlife (WDFW), 2003. Stream Habitat Restoration Guidelines. Washington Department of Transportation. Washington Department of Ecology, Olympia, Washington.

Washington Department of Fish and Wildlife (WDFW) and Point No Point Treaty Tribes (PNPTT), 2000. Summer Chum Salmon Conservation Initiative – An Implementation Plan to Recover Summer Chum in the Hood Canal and Strait of Juan de Fuca Region. Washington Department of Fish and Wildlife. Olympia, WA. 800 p. Available at: <http://wdfw.wa.gov/fish/chum/chum.htm>.

Williams, G.D., R.M. Thom, M.C. Miller, D.L. Woodruff, N.R. Evans, and P.N. Best. 2003. Bainbridge Island Nearshore Assessment: Summary of Best Available Science. PNWD-3233. Prepared for the City of Bainbridge Island, Bainbridge Island, WA, by Battelle Marine Sciences Laboratory, Sequim, WA.

Zerbe, R., and D. Dively, 1994. Benefit Cost Analysis in Theory and Practice, New York: HarperCollins.